MAY 31 1924

Engineering Library

Engineering News-Record

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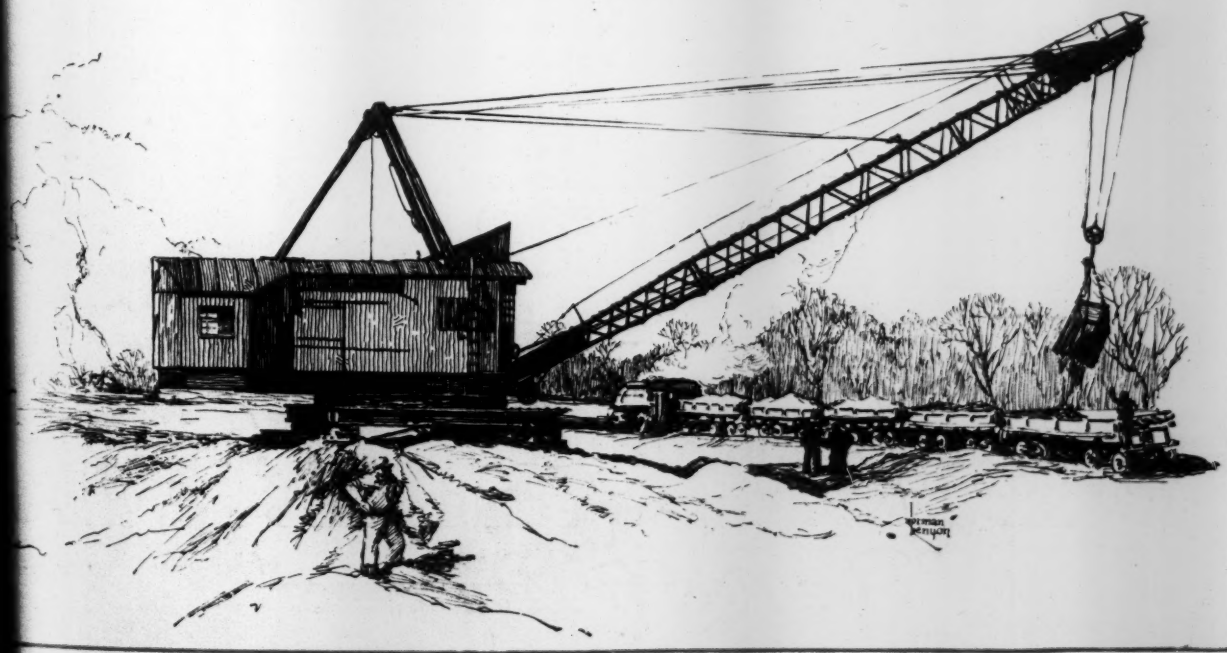
May 29, 1924

Few better opportunities for studying equipment performance records are ever afforded than those which the construction of flood-control works in the Miami Conservancy District presented. In the five last years of construction work more than 13,000,000 cu.yd. of earth and rock excavation were disposed of. It is at once obvious that there must be very valuable performance data connected with the methods of handling this material. Some of these data, carefully compiled, are presented in this issue in an article written by C. W. Ullom, Assistant Engineer of the District at Dayton, and entitled:

An Economic Study of Dragline Excavator Operation

It is an exhaustive report divided into one article on performance and cost and a second on specific features of operation. Mr. Ullom has given in this, the first extensive study of the sort published, information on comparative performance of practically every type and size of dragline; steam, electric and gasoline-driven. Such special studies as economic width of cut, performance on curves and grades, cables, mounting, and electric losses in submerged transmission cables are included. It is a study in which engineers who specify and contractors who build will be universally interested.



Plant of the A. M. Castle Co., Chicago—roofed with Federal.

Years of roofing experience

THOUSANDS of Federal installations have been complete lessons in every detail of building varied types of roofs—so much so, that almost every conceivable roof problem has been solved many times by the Federal Organization. This experience makes true the statement that no other roof can be worth as much.

If builders would make a careful cost comparison, they would find—as hundreds have found—that the beauty of Federal Roof Tile is a luxury that costs nothing—that it is a mark of inherent permanence entailing no maintenance expense. The uniformity of manufacture and perfect design, are other qualities that make Federal Cement Tile the most economical of all roofs.

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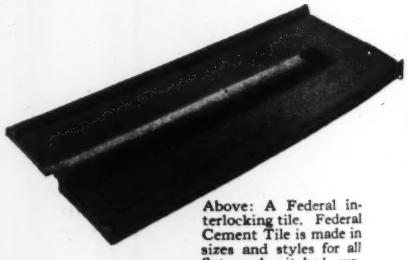

Above: A Federal interlocking tile. Federal Cement Tile is made in sizes and styles for all flat and pitched surfaces. It is made with glass inserts for top-lighting.

FEDERAL Cement Tile

"The Roof for Permanence"

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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A Correction

IN AN editorial entitled "Foresight Needed," in *Engineering News-Record*, Feb. 14, 1924, p. 267, the desirability of complete underground explorations prior to beginning construction operations was emphasized, and the conditions surrounding the construction of the Jim Falls hydro-electric plant in Wisconsin, described on another page of the same issue, were used an an example. It now appears that the nature of the preliminary subsurface investigations was not completely set forth in the article in question and that those investigations are now the subject of controversy. While the general truth of the deductions of the editorial cannot be disputed, it is only fair to say that additional facts submitted and statements made are sufficiently contradictory that we do not now feel warranted in applying the general truth to this particular work.

To Promote Craftsmanship

MEDALS, honors, degrees, awards, are desired and desirable only in so far as they are respected. When they are so respected, they take on a value far beyond anything that money can give. Down in Philadelphia, the local building congress is going to try to establish a respect for the craft of building by a certification program which will recognize superior craftsmanship in every step of the building business. First, the congress is going to collect the names and addresses of all field workers in the building industry "who are qualified to perform and are performing satisfactory services in their respective crafts or in related lines of work," and also of all builders, subcontractors or other employers "who encourage such workers and afford them opportunities to do their best or to improve themselves." These names will be carefully scrutinized and on Jan. 1 next the congress will cause to be issued engrossed certificates to those who qualify in various phases of building. These various grades cover the mechanics, artisans, skilled workers and their assistants who are designated as craftsmen, the designers and artisans who qualify as guildsmen, the architects and engineers as master craftsmen, and the builders and subcontractors as co-operative master craftsmen. These awards are, of course, to be made only on merit. Their value, as noted above, will depend entirely upon the respect which is given them, but the Philadelphia congress has initiated a hopeful method of promoting craftsmanship.

Rapid But Healthy Growth

AS FORESHADOWED in these columns two weeks ago the convention of the American Water-Works Association in New York City last week gave evidence of continued progress—past, present and future. Fortunately the growth is healthy as well as rapid. The growth is rooted in the willing service of scores of members. It has been stimuated and guided by the Standardization Council. By means of that body and its sub-committees—increased to nineteen at the recent convention—the whole water-works field is being mapped and studied as never before. Duplication is being saved by the correlating central committee, which also spurs the sub-committee to action. Early publication of the results of the various surveys makes the material available, builds up discussion and brings out a man and a variety of information and opinion obtainable in no other way and that is essential for standardization of water-works practice. "The Manual of American Water-Works Practice" soon to be produced by the Standardization Council and its co-workers, and to be published and sold like any technical book, will bring together and co-ordinate much material essential to the water-works man that would otherwise lose much of its value because scattered and unco-ordinated.

Putting the Sections to Work

A GENIUS for organization, efficiency and stimulation of interest is shown by the plan evolved to farm out among the local and geographical sections some of the work on the Manual mentioned in the foregoing paragraph. This is all the more desirable because the association as a whole meets only once a year and has long suffered from a program so overloaded by number and variety of papers as to make it necessary to choose between killing discussion or letting many of the papers go unread. The three-ring circus provided for future conventions by adding Plant Operation and Maintenance and Fire Protection Divisions to the existing Chemical and Bacteriological Division (with still other divisions a possibility) will give increased facilities for discussion of papers and reports, but here again there is the limitation of one meeting a year. By throwing some of the committee work and the presentation and discussion of the resulting reports and association papers onto the local section, some of which already meet more than once a year, the volume of committee work, and especially of discussion of committee reports, may be largely increased in number and hastened in time—provided the same efficiency in direction and willingness to co-operate is shown in the sections as has been manifested in the central work of the association.

Up to the Superintendents

FOR years past some of the superintendents have occasionally shown restlessness and disatisfaction because, they asserted, the engineers and chemists and bacteriologists have monopolized the conventions of the American Water Works Association and filled the time with papers and discussions felt to be above the heads of men without technical training. Partly to meet this condition, a Superintendents' Day or Session has been featured on the programs for several years past. More than once these sessions have come to grief. The causes

have been various. Sometimes an overloaded and delayed program has thrust itself into the time set apart for the superintendents. Sometimes the topics up for discussion have taken such a turn that the technical men have monopolized the time. Again the superintendents have not found their tongues, or the subjects offered on the program have been hackneyed, and topic after topic has gone by, even when the genial, versatile and widely-experienced secretary has done his best to open the mouths of those sitting before him. A change for the better may now be expected. The superintendents hereafter will have not merely their day but their Division—of Plant Operation and Maintenance. It will be interesting to see how many sessions they will hold, and what direction and volume the discussions will take. It is up to the "average" superintendent, if he feels that he has not had a fair show heretofore, to make full and free use of the division created for him. That he has much to say and can say it well has been shown again and again when some of the more practical, every-day, problems of water-works operations have come up for discussion—too often when the hour was late and only a small but devoted few were left in the convention hall. Perhaps it was because the many had left the few found their voices. If this be the case then it is a further argument for the smaller group instead of the entire convention as the way to bring out discussion based on experience.

Concerning Highway Traffic Problems

IF the committee on regional plan for New York can preserve the general participation and spirit of cooperation which prevailed at its recent conference on traffic it will go far toward getting results. Over four hundred municipalities and organizations of business and professional men were represented by delegates at this conference. These are impressive figures. They, however, are not astonishing. There is no doubt that in proportion to population they could be equaled from any metropolitan district in which a serious call might be made for a conference on traffic.

The people know exceedingly well that there is a traffic problem. They know equally well that the problem presses for solution. The things they do not comprehend are the method of attack, the administrative changes required and the financing involved in its solution. This is why they turn eagerly to conference.

At this, the very beginning of its work, the New York committee naturally had little to offer beyond the facts necessary to present the problem and a good example of the method of attack in its consideration. It had no specific solution. It wisely overcame the inclination to satisfy the clamor for an immediate plan. Specific traffic remedies are important but the most important first step is the getting together of those who have to be interested if comprehensive action is to be taken. This having been done there is immediately the need of getting at the problem specifically.

The committee furnishes a good example of the way. It has wisely recognized that direction of traffic is a problem for experts. Traffic congestion relief and prevention are, in brief, a task of engineering development. No better proof need be asked than the report of the committee's engineers published in abstract in this issue. The conviction has now to be got to the people of the sort who made up the audience at the New York conference. That conference demonstrated that the interest in traffic relief exists. The object is to direct it into definite action to provide bureaus of traffic engineering—state, county and town—as there are now state, county and town road and street departments. Future conferences should be directed to this purpose.

The truth has to be driven home that it is the public through its established governing bodies which must assume management of traffic. Organizations like the committee on regional plan can do no more than point out the object and the way to it. Traffic direction is a continuing problem. It is paramountly a regional problem—intertown, intercounty and interstate. Its administration must be the task of continuing bureaus—perhaps divisions of the present department of roads and streets or perhaps separate co-ordinated departments, but in any event a component activity of public works government. Emphasis has to be laid on this fact because it is vital and is being missed.

Cost Publicity a Safeguard

PERHAPS the most complete record ever kept of dragline excavator operation is summarized in two articles by C. W. Ullom, the first of which is published in this issue. In this first article the figures are of the more familiar kind. They are cost and output records notable chiefly for their volume, for the data on rock excavation and for the comparison of electric and steam power for dragline operation. The article to follow gives records of a kind seldom made available. They cover such subjects as size of crews, time of swing, rate of travel, performance on grades and curves, economic width of cut, causes of delays and cable wear and tear. Here are unique data which deserve the careful attention of contractors operating dragline excavators.

The importance of these records, however, lies as much in the fact of publication as in the data themselves. This publication, one is constrained to say, is due to the work having been done by engineers. The flood protection work was not contract work. Had the work been done by a contractor, how much likelihood is there that the records presented by Mr. Ullom, assuming that they had been kept as carefully, would have been made free to the construction industry? This query is not made in a captious spirit. *Engineering News-Record* holds no brief for the engineer as against the contractor and it does not believe in day-labor construction as against contract construction. The question is asked because it is believed that by their reticence, if not secrecy, in announcing the abundant useful information in their possession contractors are doing themselves disservice.

A great portion of the irresponsible contracting of which the stable element of the business so continuously complains is due to ignorance of costs and of the technique of performing work. No contractor, however callow, bids less than he thinks the costs will be or undertakes operations which he knows he is not trained and outfitted to perform. He underprices his work and overextends his skill and equipment possibilities because he does not know what profitable prices and the limitations of output are. And he does not know because the contracting business lacks any fund of data of experience upon which inexperience can draw. The tyro in engineering is in far better case, indeed the beginner in almost any industrial business except con-

tracting is in far better case, when he comes to seek the records for aid, than is the contractor.

Every assemblage of truthful data such as that given out for the dragline excavator operations in the Miami valley flood protection construction helps to stabilize contracting. It helps to keep the beginner from entering quite so blindly into ways which are unfamiliar. It should be the task of the contracting business to provide these data. Instead the most useful of these which contractors can get at are being made available by engineers. It is not the purpose to assert that by the publication of cost and performance data contractors will come certainly to the promised land where work is never underpriced and performance is never overestimated. There is a great deal more than this required for sound price setting and efficient prosecution of constructions. By the same token there can be neither without a fund of cost and performance data from which to work.

Action Needed

PRESENT prospects make it seriously doubtful whether the Smith reclamation bill, devised to remedy the defects of the existing law under which federal aid has been given to western irrigation, can secure enough attention to assure its being reported out of committee and being made law by Congress. Failure of the bill would mean a genuine loss to the country, a loss of sufficient moment to justify every fair effort to press the bill toward enactment. The issues involved are peculiarly the concern of engineers, and therefore, while every citizen has an interest in the passage of the bill, there is special reason for engineers to bestir themselves to secure its passage.

The Smith bill represents the outcome of the past winter's exhaustive study of reclamation on the part of the Board of Special Advisers which recently reported. It is wisely drawn. The experiences of many years, paid for by millions of dollars of public money, are embodied in its protective and promotional clauses. The irrigation farmers need the support which their efforts would obtain under the present law. The entire West, in fact, needs the law in order to stabilize its all-pervading irrigation development, to rescue irrigation from fundamental uncertainties now surrounding it and convert a hazardous gamble into a business development of assured character. And therefore the whole country needs the law. Any influence exerted to promote passage will be applied in the public interest.

As to the concern of engineers in the bill: Revision of the reclamation law affects both their past work and their future work. The great reclamation enterprises for whose protection the bill is primarily drawn are the product of engineering thought and labor. As conditions have evolved, however, the very effectiveness and usefulness of these works are in jeopardy, and the profession whose skill created them now has a personal interest in saving them from misdirection and assuring their productiveness. Its interest in future reclamation work is, if possible, even greater. Unless proper safeguards are thrown around future reclamation development, such development will be impossible; it cannot safely be undertaken and if undertaken is bound to prove a delusion and a waste. With the help of the new legislation, on the other hand, additional development may be carried out on a feasible and profitable basis.

Ample proof is at hand that the proposed law is good, that it will cure many ills with which Western land reclamation and irrigation farming have become effected. The proof lies in the careful and conscientious study of all details of the subject on the part of the Reclamation Advisers, in the supporting judgment of those who have lived with the problem and know its difficulties from personal experience, and in the testimony given at the hearings upon the bill before the house committee. Despite this ample proof, the fate of the bill is in doubt. Congress acts but slowly, and in the unusual present conjuncture, where Congress is under great pressure to adjourn within a few weeks and is engaged in sharp contests over taxes and other major problems, quick action is required.

In commending the bill, two weeks ago, and suggesting that it merits the support of the engineering profession, we relied on the urgent need for the new legislation to assure its prompt consideration and passage. Events since then, however, have so shaped themselves that only the strongest appeal can force it to a vote. Everyone who realizes the need of action by Congress can contribute to this appeal by addressing to his representative at Washington the request that he urge an immediate report on the bill by the Committee on Irrigation of Arid Lands, and work to bring about a vote upon the bill.

If a special spur to the enactment of this new legislation were needed, it would be supplied by the fact that, in a very similar situation, constructive action has already been taken in another great irrigation-farming country, namely Australia. With less important issues, and less experience to serve as guide, the Australians have worked out sound modern legislation for irrigation development, while our legislation lags. The state of New South Wales, faced with the necessity of organizing and managing a large irrigation settlement, has enacted a law embodying principles much like those of the Smith bill. These laws recognize the necessity for careful determination of the all-around practicability of a proposed irrigation before it is undertaken. They require that settlement shall be based on a reasonable showing of probable success of the settler, and on a fair initial capital. The large money investment necessary to modern arid-land irrigation is recognized, and on the basis of searching investigation of the cost of farm development, a broad scheme of low-interest financing on sound banking principles is provided for. Agencies are established to give advisory aid in agriculture and marketing, and proper checks are placed upon land profiteering and speculation to protect both the state enterprise and the individual farmer. The laws engage the state and the commonwealth in a joint partnership with the settler in working out the problem of agricultural development so effectively that each partner will bear the particular burden which he is best fitted to carry.

It is precisely such legislation that we need in the United States, and that the Smith bill will in a large measure provide. The fact that a younger country has anticipated us in this legislation confirms the conclusions drawn from our own experience and strengthens the reasons for enacting a new law. The ideal provision of the twenty-year-old reclamation act are as sound and good today as they were two decades ago; but the new law will remedy the omissions and weaknesses which have made the law a partial failure.

Activities of Water-Works Engineers and Operators

Abstracts of Papers, Committee Reports and Discussions Before the Forty-Fourth Annual Convention of the American Water Works Association

Government Requirements and Professional Standards

By George C. Whipple
Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.

THERE is a strong tendency nowadays to standardize and grade, to classify and "score," and there is also a desire on the part of many to have all this done by government. Some of the suggested laws and regulations looking to this end are of questionable legality; and it is probable that some sections of existing building codes and health laws would be declared unconstitutional if fully presented before the courts. It ought to be profitable, therefore, to consider the fundamental principles involved and a few of their applications.

Police Power—When government makes a requirement in regard to the quality of food or water or sets up a building or plumbing code, it acts under what is called the "police power." This is an element of common law. One finds it in court decisions, not in statutes. It has never been exactly defined. The United States Supreme Court has even refused to define it. Usage has established the principle that its purpose is to *prevent injury*, not to produce benefits; to prevent the bad, not to secure the good. Its recognized scope is to prevent injury to the health, safety, morals—and some recent decisions have included welfare—of the people. Under the police power government may prevent the use of water likely to injure the health, may prevent types of building construction which threaten safety, may require certain protective devices in house drainage systems, and so on. Attempts at compulsory betterment by law have indeed been made but, regardless of constitutionality, have not been successful.

Government Requirements—There is often a disposition to regard a government requirement as a standard of excellence. Minimum requirements tend to become maximum practice. If a requirement is made too low, there is danger that this scaling down will occur; if it is made too high, it is likely to work injustice to many. Even if it is reasonably fixed between high and low, the effect is likely to be one of leveling.

Professional Standards—Professional standards ought to be higher than legal requirements. How absurd it would be to let law govern the fine arts! It ought to be reiterated by professional men until the people understand it that what the law sets up are not standards of excellence but limits to inferiority.

One reason why people get this false impression is because legal regulations sometimes go too far and too much into detail. This is true, for example, of plumbing regulations. Some of the codes are veritable specifications, obviously intended to improve practice and force people to install what is best. The underlying motive was good, and we should find no fault with such codes except this—that they ought to be set up as standards by the plumbing crafts and not made compulsory by law.

Standardization—There is a strong demand also for standardization—especially standardization of the dimensions of things. There is need for the elimination from trade catalogues of many little-used articles, for "simplified practice" as Secretary Hoover calls it. This movement has already made headway in several branches of the building trade. It is badly needed in the field of plumbing. When the Sub-Committee on Plumbing of the Building Code Committee of the United States Department of Commerce began its labors, it took up the subject of standardization, but after devoting much time to it reached the conclusion, stated in its final report, that standardization is desirable but should be brought about by agreement and not by law.

Grading—Grading water supplies according to quality on a scale from excellent to bad is useful. It is an incentive to improvement. It may be done by government—for example, the United States Public Health Service or state departments of health—but in my opinion it is better to have standards of excellence set up as professional standards. Water-works standards might appropriately be set up by the American Water Works Association working in conjunction with the American Public Health Association, the former representing the "producers", the latter representing the interests of the consumers. The United States Public Health Service and perhaps the sanitary engineers of the various states might well have a part in the proceedings. If "water-works standards" thus arrived at were promulgated, they would set the pace for excellence and raise the general level of quality, so that the employment of the police power to prevent the use of water below the government requirement would seldom be necessary.

United States Treasury "Standard"—Tentative suggestions for the revised Treasury Requirements for potable water supplies have been distributed for criticism and already claims are being made that they are too high or too low. If they are really too high, the public water supplies of many cities, which have long been used without injury to health, will not conform to them. If too low, they will be regarded as stamping with approval supplies which are unsatisfactory. The discussion has already shown that there is a real demand for a standard of excellence, but that for the goverment requirement to be at the same time a limit of impurity and a standard of excellence is practically impossible.

In devising "professional" or "water-works" standards of quality, many items need to be considered—color, turbidity, taste, odor, chemical analysis, bacterial content, and so on. It will be necessary to decide what is meant by such terms as pure and impure, good quality and poor quality, high, mediocre, and low quality, and the like. It may be necessary to have different scales for different parts of the country. It will certainly be necessary to consider the element of time or frequency. Perhaps some such scheme as the following might serve:

Supplies Approved by Government

Class A. High quality all the time.
Class B. High quality part of the time; mediocre quality part of the time.
Class C. Mediocre quality all of the time.

Supplies Not Approved by Government

Class D. Low quality part of the time.
Class E. Low quality all of the time.

The writer makes no attempt to suggest a system of grading, classification, or scoring. It is a difficult and delicate matter, but it ought not to be impossible for water-works engineers and sanitarians to decide upon some classification adequate for practical purposes. The present committee working on the revision of the Treasury Requirements may itself be competent to set up professional standards as well as minimum requirements, but it would certainly be better to have these standards backed by such large and vitally interested bodies as the American Water Works Association and the American Public Health Association, instead of being sponsored by the United States Public Health Service alone.

Résumé—The writer advocates the following principles applicable alike to building construction, plumbing, control of water supplies, and other matters of sanitation:

1. Government requirements, not too high, intended to prevent injury, and justifiable under the police power, to be established by law.

2. Professional standards of excellence, standard specifications, grading, and the like, higher than government requirements, to be established by agreement, not by law.

3. Government requirements and professional standards to be interlocking.

4. Government requirements to be uniform in the different

states, as far as practicable, in order to facilitate the establishing of professional standards by agreement.

5. Professional standards to be varied geographically, or in other appropriate ways to meet practical conditions.

* * *

Superintendents Have Their Day

BY VARIOUS SUPERINTENDENTS

A HALF DAY was set apart for water-works superintendents, but special provision was made for them at various other places through the program. The entire afternoon of Friday was taken up in this way, chiefly with topical discussions of subjects picked from a list sent out to the members in advance. There were three more or less formal papers scheduled for this section. One of these by Mr. Highland is abstracted elsewhere; one on a new well system at Holland, Mich., by R. D. Champion, was not presented; and one entitled Keeping an Antiquated Plant in Tune, by W. S. Cramer, proved to be an interesting offhand talk. Mr. Cramer said that his company at Lexington, Ky., being confronted with high cost of coal and other operating features combined with inadequate water rates found the introduction of economies necessary. Accordingly he did such things as put in a CO_2 recorder and other efficiency checking appliances. In addition, firemen were paid premiums varying with a percentage gain in evaporation. By these and other means 20 to 25 per cent of coal was saved. Other economies both in first and operating costs were effected by installing a gasoline-driven engine. This not only obviated the necessity of putting in a more expensive pump but obtained better fire rating.

Seasonal Distribution of Freight—At the request of the United States Chamber of Commerce, the possibility of better seasonal distribution of freight in order to avoid railway congestion had been placed on the program. Nothing was offered in response except that J. E. Gibson, Charleston, S. C., said he had been told by one of the pipe companies that the agitation for winter buying of pipe had swamped it with orders.

Flushometers—There was an apparent consensus of opinion that flushometers should be discourage because of the large service pipe generally demanded to make them efficient. The placing of an expansion tank on the service, instead of using a larger service, was endorsed by some of the speakers. Mr. Gibson, of Charleston, said that he had had no trouble with flushometers because of the fact that a service charge depending upon the diameter of the service is collected in Charleston and when a house owner asks for a 1½-in. service and finds that it is going to cost him $12.50 a quarter, he decides that he can get along with the old style of flush tanks.

Useful Tools or Appliances—For temporary use while meters are out for test, one speaker said that he had used nipples with rubber hose arched in between, while another one used the ram's horn meter yoke.

Leadite—Most of the experiences with leadite cited were eminently satisfactory, but there were one or two exceptions, followed by suggestions that the material had not been properly manipulated, especially as regards heat.

Pipe Cutting—W. M. Rapp, superintendent of construction, Atlanta water-works, reported the successful cutting of 48-in. cast-iron pipe by boring thirteen 1-in. holes circumferentially around the pipe and driving in wedges. A clean break was obtained. William H. Buck, engineer and superintendent of construction, Riverton and Palmyra Water Co., Riverton, N. J., said that he had used somewhat the same method, only between the holes he had scored a line with a diamond point before using the wedges.

Leak Location—The use of the Geophone and of the Darling instrument for locating leaks in pipe was a topic that brought out a number of experiences, most of them satisfactory, except that some had experienced difficulty with the Geophone owing to its sensitiveness and resulting confusion with other noises than those of the leaking water.

Reforestation—J. M. Diven said that the Water Board of Troy, N. Y., has planted a half million pine seedlings and now has an application in for 1,200,000 more, which will cover the entire drainage area owned by the city. The state of New York now supplies seedlings for such purposes without charge. A representative from Glens Falls, N. Y., stated that there had been planted in his watershed 1,000 acres with some 1,200,000 trees at a cost ranging from $2.25 to $8 per thousand according to topography.

Sedimentation Experiences at Omaha

BY THEODORE LEISEN

General Manager, Metropolitan Utilities District Board, Omaha

SEDIMENT accumulating in the settling and coagulating basins at Omaha was until recently removed by drawing down the water and then flushing out the mud by fire streams through mud valves. This has been changed so the sediment is flushed out by the pressure of the water above it without throwing the basins out of use. The Missouri River at times carries sediment as high as 2,500 p.p.m. Now and then the mud will accumulate in a basin to a depth of many feet in 24 hr., sometimes requiring, under the old scheme, shutting down a basin and flushing out the mud twice a week.

After three weeks' use of the new plan one of the basins, on having the water drawn off, showed only 6 in. of mud at the bottom.

Discussion: George W. Fuller, New York City, said that in 1923 there was more mud in the water at Kansas City, Mo., than there had ever been before. There is no doubt but that mud must be removed from the water before filtration. In the new works projected for Kansas City, Dorr thickeners will be used in the settling basins.

* * *

Weather Bureau at the Pumping Station

BY SCOTLAND G. HIGHLAND

General Manager, Water Board, Clarksburg, W. Va.

A WEATHER BUREAU observatory at the pumping station will bring the water department on a scientific mission into every home in the city it serves. The people of the county in which the meteorological station is located will be enormously benefited because of the additional useful data collected and daily disseminated by the local newspapers. The Clarksburg Water Board maintains twelve rainfall stations on its watershed, comprising an area of 385 sq.mi. At the pumping station a recording rain gage is maintained. The observers in charge of the rainfall stations located in the watershed are requested to furnish the farmers and all other interested persons with the data collected. Maximum and minimum registering thermometers have been installed at five of the twelve precipitation stations for the sole benefit of the people on the watershed.

* * *

Allocation of Water Supplies from Interstate Streams

BY LEONARD C. WOOD

Assistant Engineer, Board of Water Supply, New York City

FLOWING waters, whether above or underground, should be in public ownership; should be administered on a regional if not a national scale, the region transcending not only state lines but divides as well; beneficial use should govern, with an established order of preference, except that domestic and municipal water supplies should come first; the better right within each preference class of use should be determined by priority in time of perfected use; allocation should be limited with due regard to economy and efficiency of use . . . ; rights not promptly utilized should be abandoned to the public . . . . The discussion before the American Society of Civil Engineers by Clarence P. Johnston (*Transactions*, 1915, p. 630) is highly illuminating. Domestic and municipal water supply will doubtless always be recognized as the highest use. The relative order of other classes of use varies with progress in the art concerned and with predominant local needs; that is, with time and place.

In any current project of large magnitude it is the writer's feeling that an interstate commission to examine the situation, formulate a policy and recommend an allocation, such allocation to be embodied in a treaty between the states, offers the line of least resistance and greatest present promise. [See May *Journal*, A.W.W.A., for paper in full.]

Discussion: Morris Knowles, of Pittsburgh, stated by letter that the Pennsylvania Legislature has made an appropriation for the co-operative study with the federal gov-

ernment of water-supply problems incident to a federal forest reserve common to Pennsylvania and Ohio. A. W. Cuddeback, Paterson, N. J., said the problem of allocation must be approached long before the need for its application arises in order to create public sentiment in advance. Nicholas Hill, New York City, said the water-works men of the country must begin to think topographically instead of by political boundaries. Thomas H. Wiggins, New York City, reverted to the necessary giving up, years ago, because of probable legal complications, of the taking of water from the Ten Mile and Housatonic Rivers for New York City, which would have been very much cheaper than going to othe Catskills.

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Steam-Turbine-Driven Centrifugal Pumps at St. Louis

BY LEONARD A. DAY
Chairman of Committee on Pumping Station Betterments; Mechanical Engineer, St. Louis, Mo.

STEAM-TURBINE-DRIVEN centrifugal pumps have been used for pumping raw water at the low-service station of the St. Louis Water Department for some time, two units of this type, each having a nominal capacity of 40 m.g.d., having been installed in 1912. These units are driven by an impulse steam turbine, very simple in design, consisting of only one high-speed turbine wheel. They have been very satisfactory from the standpoint of reliability, the only difficulty being due to cutting of the turbine buckets on the wheel during the time that saturated steam was in use at the plant. With the introduction of superheated steam, erosion has practically disappeared. If the wheel becomes worn, it can easily be removed and rebladed at the plant.

A new turbine-driven centrifugal pump having a capacity of 110-m.g.d. against a head of 65 ft. was placed in service in March, 1919. This unit is of the conventional geared type, but the turbine, being much larger than the original units, is provided with 13 velocity stages for economy. The operation of this machine has not been as free from difficulties as that of the smaller and more simple single-stage turbines. It was noticed after this machine had been in service for practically two years that a considerable dropping off in capacity took place. It was no longer possible to operate the unit at its full capacity.

At first it was believed that the water end was causing the trouble. Consequently a new impeller and new wearing rings were put in and the water end was completely overhauled. This did not correct the trouble and it was decided that the steam end or turbine should be looked into. In the summer of 1923 the first duty test to check the original trials was made, four years and seven months after the unit was put in service, and we found that the duty had dropped approximately 25 per cent as compared with the original test. It was also impossible to pump more than 95 m.g.d. with all the nozzles on the turbine open. This condition convinced us that there was something radically wrong with the turbine, since the water end had just been overhauled and was in first-class condition.

In an effort to correct the choked-up condition of the turbine (we were positive by this time that the steam end was choked or coated) we undertook to dissolve with kerosene the foreign matter in the turbine. About one barrelful of coal oil was pumped in at the throttle with a steam pump as the machine was being shut down. After the use of coal oil, the unit was again tested, the results showing practically no change in capacity or duty. It was concluded that it would be necessary to take down the steam end of this unit, in order to determine just what had caused the loss in efficiency and ability to carry load. After completely dismantling the rotor about one-half of the buckets in the wheels and guide vanes in the diaphragms were found clogged with scale. The presence of oil aggravated the accumulation of scale by building up a sticky carbonaceous mass. All of the scale-forming material, together with the oil, was undoubtedly brought over from the boiler in the steam. In addition to this partial stopping up of the passages there were evidences of cutting action, due in our opinion, to the erosive action of the solid matter carried in the steam. This cutting action required the replacement of the sealing rings which prevent steam leakage along the shaft, and the reblading of five of the wheels. The high-pressure nozzle ring was cut badly, jagged openings having been cut through the thin wall separating one nozzle from the other. This part was also replaced. The wheels which did not require reblading were cleaned with a sandblast, a method which proved to be the best. Soaking in boiling caustic solutions softened the scale, but did not remove it.

After assembling the machine two duty tests were made to determine the gain in economy and capacity. It was found that not only was the full capacity easily obtained, but that the duty had been practically restored as compared with the original tests.

In an effort to correct the present conditions we contemplate the use of steam purifiers connected to the boiler outlet nozzles inside the steam drums. It is hoped thereby to eliminate any possibility of the steam carrying foreign matter in an appreciable quantity into the turbine.

It is hoped that this information will not be construed as detrimental to steam-turbine-driven centrifugal pumps, but that it will point out the importance of investigating any steam conditions which might cause the carrying over of foreign matter into turbines. Incidentally the importance of test work to determine when extensive repair work should be started and to find out the benefits derived from such work has again been brought out.

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Iodine Treatment at Rochester

BY BEEKMAN C. LITTLE
Superintendent of Water Works, Rochester, N. Y.

SINCE the reading of my paper a year ago on treating the water supply of Rochester, N. Y., with sodium iodide to prevent goitre, I have received inquiries and newspaper clippings on the subject from all over this country and several foreign countries as well. Most of the press comments have been unfavorable or at least doubtful.

The Rochester supply was first treated in April, 1923. It was treated again in September of that year, and now a spring dose is being administered. At the present contract price for sodium iodide of $4.35 a pound, and with a use of 700 lb. a year, the treatment in Rochester costs about 1c. a person. We are not sure that combating goitre through the water supply is the best way, but it is one way.

Discussion: Dr. George W. Goler, health officer of Rochester, stated that it should be understood that the use of sodium iodide is not for the purpose of treating goitre, but for preventing the trouble. Several others took part in the discussion, some on one and some on the other side of the wisdom of employing this method. Most of those in opposition assumed that it would be cheaper to give special treatment of the comparatively few suffering from goitre rather than to treat the entire population of a city, but those who took the opposite view urged that wholesale treatment is the only efficacious available method of prevention as contrasted with the cure. Prof. George C. Whipple, of Harvard University, said that some of his medical colleagues on being questioned did not favor the Rochester plan, giving as a reason that it has not yet been proved that goitre is an iodine deficiency disease.

* * *

Fire Protection

BY GEORGE W. BOOTH, CLARENCE GOLDSMITH, V. B. SIEMS, LOUIS STOCKLMEIR AND FRANKLIN H. WENTWORTH

THE FIRST of a group of five papers and discussions on various aspects of water supply for fire protection was read by George W. Booth and the second by Clarence W. Goldsmith, heads respectively of the New York and the Chicago offices of the Underwriters Committee on Fire Prevention. Mr. Booth dealt with flow tests. In the work of the Fire Prevention Committee it was early seen that pressure tests alone were insufficient as indexes of fire protection service. Flow tests are now made at each of a group of hydrants, by passing pitot tubes across the discharge from an open hydrant nozzle. A pressure gage is attached to the upper end of the tube. Emergency conditions may be simulated by shutting off a big feeder main. Mr. Goldsmith dealt with fire protection requirements in sma

towns. In the center of the fire district mains should enter from two opposite sides, say one from the pumping station and one from a storage reservoir.

Papers by Mr. Siems on Fire Flow to Be Provided in Large Cities Under Various Conditions of Risk, and by Mr. Stocklmeir on Effect of Distribution Systems Designed Upon Fire Insurance Rates, published in the *Journal* for January and May, 1924, were taken as read. Mr. Wentworth opened his remarks by stating that the fire waste of the country now averages $500,000,000 year, 80 per cent of which is preventable by ordinary care. On a per capita basis American fire wastes are $5 compared with 33c. per capita in Europe. American apathy in this subject is largely due to the mistaken notion that the fire insurance companies meet fire losses, whereas in fact the fire waste tax in the form of insurance premium is added to all manufactured goods every time they change hands.

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Committee Reports

Abstracts of committee reports and discussions representing part of workl done under the direction of the Standardization |Council

Standardization of Water Services

JOHN M. DIVEN, Chairman

THE COMMITTEE on Standardization of Service Pipes desires to find a material that will meet all conditions—cost, serviceability, and health. It would be helpful if all the water-works of the United States would have their water supplies analyzed with a view of determining the effect of the water on services—but they will not do it.

Discussion: Related to the remarks by Mr. Diven was a paper on "Action of Water on Service Pipe," by Wellington Donaldson, of Fuller & McClintock, New York City. Mr. Donaldson summarized data recently collected and published by *Public Works*, based on a questionnaire sent to 800 water-works, of which 539 reported. From these data Mr. Donaldson concluded that galvanized iron is the leading material used for service pipe. Protective measures are relatively simple and inexpensive, he stated. [See *Journal* A.W.W.A., May, 1924.]

Frank N. Speller, metallurgical engineer, National Tube Co., Pittsburgh, Pa., stated that oxygen concentration rather than carbonic acid is the prime factor in the corrosion of service pipes. He also stated that the common assertion that galvanized steel has a shorter life than galvanized wrought-iron pipe is unwarranted. Mr. Speller classified the agencies having most to do with the lift of service pipe through which there flow alkaline, neutral and acid waters, as follows:

Alkaline	Neutral	Acid
Film	Oxygen consumed	pH
Oxygen concentration	Temperature and velocity	Over voltage
pH	Film	Oxygen concentration
Temperature and velocity of water	pH	Composition
Composition of pipe	Composition	Temperature and velocity
	Over voltage	Film

R. S. Weston emphasized the importance of oxygen in corrosion and illustrated it by stating that since the filtration plant was put in use at Brookline, Mass., and the water thus changed from a high carbonic acid to a high oxygen concentration quality, it had been found that tin-lined brass is the only kind of pipe that will stand up for use in house piping—the service connections being cement-lined wrought iron. Mr. Weston suggested the general adoption of cement-lined services, and noted that the lining has been greatly improved of late. D. A. Heffernan, superintendent of water-works, Milton, Mass., said that twelve years ago he found lead and galvanized-iron services not giving good satisfaction. Cement-lined black iron was substituted. This is now being lined with Rosendale cement-mortar shot in by a gun, then smoothed by drawing through a cone. The outside of the pipe is cleaned and coated with tar paint. Lead-lined fittings are used and, to give flexibility, lead goosenecks.

Testing Water-Works Materials and Supplies

THOMAS H. WIGGIN, Chairman

THE COMMITTEE assumes that it is not responsible for subjects already covered by other committees and associations, including those on water meters, standard brass fittings, cast-iron pipe and specials, standardization of services and steel pipe lines; nor on standardization work already done or in hand by the American Society for Testing Materials, the American Engineering Standards Committee, the Bureau of Standards, etc. Action by the A.E.S.C. tends to delay a specification but to make it more broadly applicable. [The report then passed in review a number of existing specifications formulated by or for one society or another, including steel, wrought iron, coatings for iron and steel, non-ferrous metals, cement, lime and clay products, coal, coke, and lubricants, timber, rubber products, and others, and gave specifications for quick lime, soda ash, sulphate of alumina, bauxite, sulphuric acid, and chloride of lime. See *Journal*, A.W.W.A., May, 1924.] ,

The first step toward the formulation of standard specifications for the zinc coating of materials of iron and steel was taken at a conference held in New York on Jan. 29, under the auspices of the A.E.S.C. At this meeting your committee was represented, and the fact that a protective coating which gives good service under atmospheric exposure may be wholly inadequate with under-water exposure was brought out.

Discussion: T. H. Merriman said that portland cement is the only product known in which little advance has been made in the last twenty-five years (except as to uniformity). The subject needs study. Alfred D. Flinn, secretary, United Engineering Societies, New York City, stated that inquiry indicates that good galvanizing can be done, but that some of the commercial concerns do not use enough of the coating and that the coating cracks. F. W. Green, superintendent, filtration and pumping, Passaic Consolidated Water Co., Little Falls, N. J., said there is a movement on foot for a million dollar fund for the investigation of colloids—a quarter of the amount for plant and the rest as an endowment.

* * *

Industrial Wastes in Relation to Water Supply

ALMAN L. FALES, Chairman

IN OUR PROGRESS report of 1922 (see *Journal*, A.W.W.A., May, 1923) it was shown that more than 250 water supplies widely distributed through the United States and Canada have been injuriously affected by at least twenty different kinds of industrial wastes. The present report deals with the agencies in this country and abroad which have to do with the control of pollution by industrial wastes. [The powers, duties and work of these various agencies were reviewed. See *Journal* A.W.W.A., May, 1924.]

State legislation is needed in some states to control adequately industrial waste pollution. National legislation is needed to control pollution of interstate and coastal waters. All legislation must be considered from the broad viewpoint of public welfare and should be based on the results of thorough investigation. The importance of securing the co-operation of all interested parties must not be overlooked.

Discussion: H. G. Moses, chief engineer, Pennsylvania Department of Health, stated that the Pennsylvania Sanitary Water Board has made a start in classifying the "clean streams" of the state. The state attorney general of Pennsylvania has recently ruled that the Sanitary Water Board has jurisdiction over the discharge of wastes that would cause tastes and odors that would keep people from drinking water in sufficient quantities for their needs or turn them to drinking other water more attractive but less safe hygienically. H. R. Crowhurst, sanitary engineer, United States Public Health Service, said that studies of water supply pollution by phenol waste have led to the conclusion that such pollution could be prevented in the states where it is occurring without additional state legislation. Many of the largest plants producing phenol waste are now keeping 100 per cent of the wastes out of the water or else treating it before discharge. It will be possible to study the phenol problem at the new testing station of the Public Health Service at Cincinnati.

Filter Sand Testing and Recording

PAUL HANSEN, Chairman

THE SPECIFIC duty assigned to the committee is that of inquiring into methods for testing and recording filter sand. These items cannot be intelligently discussed without rather fully considering experiences with the use of filter sand. In the hope of stimulating discussion, the committee submits a short historical sketch of the examination of filter sand. [Review of early work at the Lawrence (Mass.) Experiment Station; comment on Hazen's method; Abram's fineness modulus; sieve standardization with specifications for standard sieves; see *Journal*, A.W.W.A., May, 1924.]

Conclusions—Mechanical analysis is of value in determining change in size of sand due to losses of fine material during washing and the effect of incrustation due to lime, iron and manganese. Physical analysis by an observation of color, odor, shape of grains and shrinkage gives considerable information on the condition of the sand beds including incrustation and organic growths. Mineral chemical analysis brings out the nature of incrusting materials. Organic chemical analysis would give a measure of the extent of organic growth within the bed and a measure of the effectiveness of cleansing methods.

The recent investigations of John R. Baylis at the Montebello filters in Baltimore have emphasized the importance of microscopic analysis as throwing light on the condition of a filter bed. This gives a measure of the thickness of gelatinous films on sand grains which appear to bear an intimate relation to the behavior of mechanical filters. According to studies by Baylis, a certain amount of this organic growth is necessary to efficient filtration, while too much gives rise to crack formation and clogging. [See *Engineering News-Record*, March 27, 1924. p. 516.]

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Sanitary Drinking Fountains

S. T. POWELL, Chairman

NUMEROUS investigations carried on in the past few years have demonstrated clearly that the straight jet fountain, permitting the incoming water to pass through a cup or reservoir that is not drained, and other poorly designed apparatus, may result in the transmission of bacteria from one person to another. The conclusions reached by the committee of the Iowa Section of this Association, in its report of Oct. 23, 1919, are endorsed by your committee and are given herewith, in full:

1. All types of drinking fountains with vertical jets are to be condemned.

2. Most types of drinking fountains with slanting jets are to be condemned.

3. To be sanitary, drinking fountains should conform to the following specifications: (a) The jets shall be slanting. (b) The orifices of the jets shall be protected in such a manner that they cannot be touched by fingers or lips, or be contaminated by droppings from the mouth, or by splashings from basins beneath the orifices. (c) The guards of the orifices shall be so made that infectious material from the mouth cannot be deposited upon them. (d) All fountains shall be so designed that their proper use is self-evident.

* * *

Standards for Drinking Water

DR. A. W. FREEMAN, Chairman

A SYNOPSIS of the new Treasury or United States Public Health Service standard in its tentative stage was submitted. The center of interest of the proposed new standards is B. Coli as an index substantially along lines announced a year or so ago. It is proposed to add some desirable elements of a sanitary survey and requirements as to chemical and physical qualities of water. A paper entitled Government Relations and Professional Standards was presented by Prof. George C. Whipple, of Harvard University, and is included in abstract on p. . .

Dr. Allan J. McLaughlin, United States Public Health Service, said that the biggest achievement in the revision is providing for a sanitary survey. The Public Health Service is to obtain results, not by force but by educational measures.

William Firth Wells, of the New York State Conservation Commission, remarked that it would have been well if Prof. Whipple's paper had been written and presented before the Revision Committee began its work—apparently having in mind Prof. Whipple's suggestion for standards of professional excellence, on the one hand, and certain government requirements designed to guard against the use of bad water on the other. Harry C. Jordan, of the Indianapolis Water Co., urged that standards of purity must take their place in the whole scheme of public water supplies with a view also to other public health needs and that care should be taken not to go too far in requirements for the quality of water lest it be impossible to get the necessary money to carry out such requirements.

* * *

Water Shed Protection

W. L. STEVENSON, Chairman

SURFACE water supplies are derived from catchment areas of widely varying character and hence the degree of water purification and water protection likewise varies between wide limits. To illustrate these principles the committee submits five contributions prepared by district engineers in the Bureau of Engineering of the Pennsylvania Department of Health. [For the five contributions in full see *Journal* A.W.W.A., May, 1924.]

C. B. Mark deals with watersheds practically uninhabited but subject to chance contamination by hunters, fishermen and berry pickers. The reservoirs do not provide longtime storage. These watersheds are made subject to sanitary regulations for sportsmen's camps as well as routine patrol and inspections by the water company.

The case discussed by Ivan M. Glace is of an inhabited watershed, long-time storage facilities and intensive sanitary control. An interesting feature is the special authority conferred by the State Department of Health on a representative of the local water company for enforcement of sanitary regulations on the watershed.

L. D. Matter considers a public water supply obtained from three streams, two of which are relatively clean, but the third is subject to sewage contamination and after storms is turbid. The storage afforded the two better sources of supply has been considered sufficient, but the dangerous source of supply entered the reservoir at a point too near the intake to provide proper reduction in turbidity and bacterial content. The required safeguards, pending filtration, include enlargement of the main storage reservoir with relocation of the intake, construction of a small dam on the more dangerous stream, strict sanitary control of the watersheds, and disinfection of the water before delivery to the consumers.

A unique case is reported by J. W. Fortenbaugh. A water supply obtained from mountain streams is impounded in a series of storage reservoirs. A stream tributary to the upper storage reservoir was acid from mine drainage and has an unsewered village near its headwaters. When the city desired to intercept the acid mine drainage it was permitted, provided that a sufficient quantity of acid mine drainage be still allowed to enter the stream to act as a disinfectant, on account of the possible sewage contamination from the village.

C. L. Siebert considers the rather complicated problem of regulation of the discharge of sewage and industrial wastes on a large, densely populated watershed above the intakes of water filtration plants. The present contamination of the stream is so great that, at times, tastes and odors persist even after purification of the water by most elaborate and refined methods. Extreme care is necessary in the operation of the purification plants to prevent water of a dangerous character being served to the public. The policy adopted for protection of the watershed is interesting, since it recognizes the necessity of safe public water supplies and also gives due regard to reasonable economic requirements upon municipalities and essential industries.

Discussion: R. S. Weston, consulting engineer, Boston, said that in view of the increasing use of the automobile the uninhabited watershed is gone. As illustrating this, he stated the experience of Newark, N. J., which has acquired some 75 per cent of its Pequannock water collecting area and now finds that it must cope with the dangers of automobiles—which vehicles, Mr. Weston remarked, do not provide receptacles for preventing the pollution of the streams and reservoirs in the watershed.

Fans to Avoid Smoke Nuisance in Chicago Union Station

Low-Level Viaducts Crossing Trainshed Have Smoke Chambers in Floor with Exhaust Fans Discharging Into Open Air

REMOVING locomotive smoke from beneath viaducts across the trainshed by means of fans is a novel feature of railway station design which is included in the new Chicago Union Station. In general, the trainshed is of the low-roof type with open slots over the tracks for the escape of smoke, steam and gases, as described in *Engineering News-Record*, Dec. 6, 1923, p. 928. But it is crossed by street viaducts giving a headroom of only 17 ft. above the rails, and two of these structures are near the positions where engines of incoming trains stand on opposite sides of the transverse passenger concourse. With an engine starting to back out a heavy train or standing with its blower working, the smoke and steam would be thrown down from the viaduct deck, causing very unpleasant and objectionable conditions on the platforms. Furthermore, under certain wind and atmospheric conditions the smoke might be carried into the building.

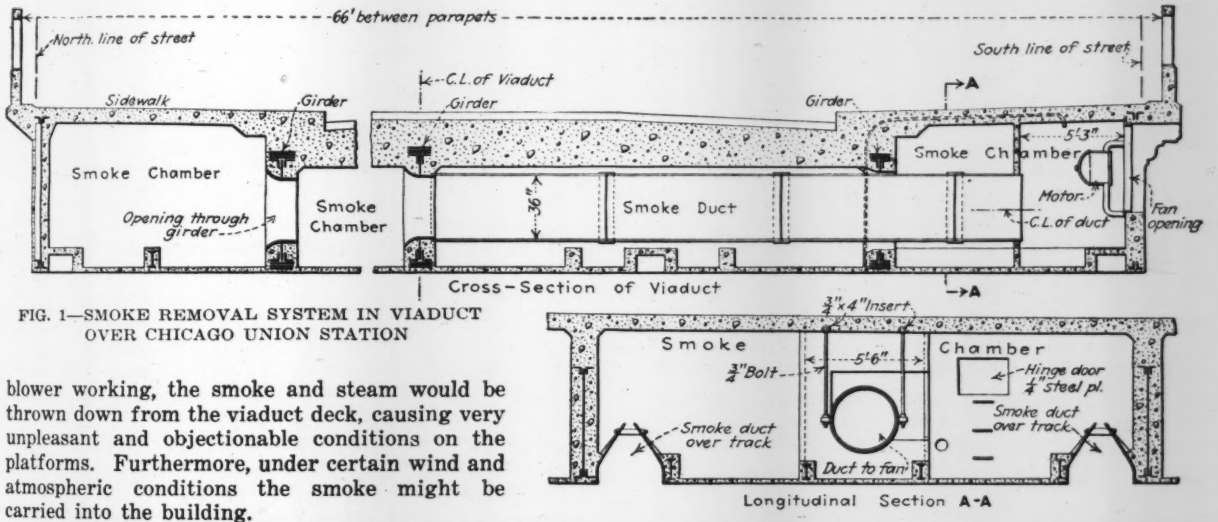


FIG. 1—SMOKE REMOVAL SYSTEM IN VIADUCT OVER CHICAGO UNION STATION

Numerous plans for smoke removal were considered, many of which were found impracticable under the circumstances, or to involve prohibitive cost. Since any system adopted would have to be incorporated in the new viaduct at considerable expense, tests were made with a full-sized model of a viaduct span built of wood and sheet iron and erected near a roundhouse where locomotives were available for the trials. As a result the Jackson St. viaduct has been built to special designs and equipped with the necessary apparatus. The Adams St. viaduct will be built on the same general plans.

In each case the viaduct construction, shown in Fig. 1, consists of five lines of plate girders, carrying a concrete deck slab for roadway and sidewalks and having a concrete protective ceiling which encloses the bottom chords of the girders. In this way there are formed four compartments in each span. These are utilized as a smoke chamber by providing a slot over each track and installing ducts and fans which discharge the smoke and steam horizontally over the adjacent roof of the trainshed, where they mingle with the discharge from locmotives standing in the trainshed. It will be seen that special girder construction is required to provide the necessary openings, so that structural considerations place limits on the sizes of fans and ducts.

A width of 30 in. for the ceiling slots was used in the test structure, but in the viaduct this was increased to 36 in. because it was found that wind had a tendency to carry the smoke to one side. Even at a very low velocity the volume of air drawn through such a wide opening would require ducts and fans so large as to be impractical. Hinged baffles were erected, therefore, at each side of the opening, 30 in. high, in the test structure, so that the inclination could be adjusted to give any desired top width of opening. It was found that satisfactory results could be obtained with a 9-in. width and an inlet velocity due to fan of 300 ft. per minute. For widths under 9 in. there was a choking effect, although in one section of the viaduct 4½ in. has been used with fairly satisfactory results, as explained later. For widths over 9 in., there was a falling off in efficiency unless the fan was increased to a size which could not well be installed in the proposed structure. From the detail of the smoke inlets, Fig. 2, it will be seen that there is an opening above each track continuous except where interrupted by the main girders. This has curved sides 30 in. deep, giving widths of 36 in. and 9 in. at bottom and top respectively.

How to obtain an equal draft condition over the entire area served by one fan was the next problem. In the test structure a series of round concentric ducts was first used, arranged like the sections of a telescope, decreasing in size as each viaduct compartment was reached, and the inlet being the annular space between the ends of adjacent portions of the duct. This system would not handle the smoke, for the reason that the area of any one of these annular openings was less than the area of the engine stack through which smoke was being discharged at high velocity.

Advantage was then taken of the balancing effect of the locomotive smoke, and it was found possible to let one fan and duct serve the two tracks under each viaduct span. The transverse partition in the structure between these two tracks was removed, the number of girders was decreased and openings were made through the girders for access and for the travel of gases, as indicated in Fig. 1. The result is that if a locomotive is standing at any point and discharging a maximum quantity of smoke, it creates a pressure zone in the structure and the gases are taken to practically the full

capacity of the fan from that point. At all other points there is a more or less balanced condition so that the direction of flow of gas or air may fluctuate, being first in and then out, but the pressure is not strong enough to force smoke out in such amount as to cause annoyance. Under these conditions an automatic damper is formed by the gas itself, and very little demand is placed upon the fan which is left free to discharge the smoke. If, on the other hand, only a small amount of smoke is thrown out, there is sufficient draft present at any point to remove it.

For the four compartments in each two-track span, a 48-in. fan is located in the south wall and from the chamber on the suction side of fan there is a 36-in. cast-iron duct leading to the opening in the girder at the center line of the street. This serves the compartment under the north half of roadway and indirectly serves the compartment under north sidewalk through the three 36-in. holes in the girder at curb line. There is a loss of approximately 15 per cent in the velocity of air entering the inlets of this sidewalk section, due to the indirect passage to the duct. This duct was not extended to the last compartment, in order to simplify the construction and to carry out the idea of an opening in duct of sufficient size to take the full amount of smoke discharged from a stack. At the fan there is a chamber 5½ ft. square to which the 36-in. duct is connected. Adjacent to the pipe there is also an opening through wall of chamber equal in area to the pipe. Air is drawn through this opening directly from the compartment under the south sidewalk and indirectly from the compartment under south half of roadway through the openings in the girder at the south curb line.

In order to avoid the use of a second duct it was necessary to reduce the track inlet of the south sidewalk section to a width of 4½ in. Anemometer readings show an average air velocity in this compartment of 426 ft. per minute in a 4½-in. opening, equivalent to 213 ft. per minute over a 9-in. opening. The velocities for the south half roadway, north half roadway, and

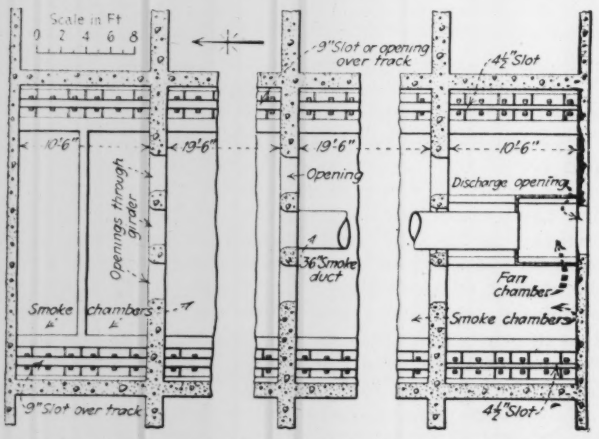


FIG. 2—SECTIONAL PLAN BELOW DECK OF VIADUCT

north sidewalk sections through 9-in. openings are 228, 218 and 184 ft. per minute respectively. The 4½-in. opening shows an increased choking effect on the locomotive gas, as was expected, but in spite of this the action is fairly satisfactory. It was thought best to accept this in order to avoid duct work and to keep the openings as free and large as possible. Had the 9-in. width been retained and this compartment served by a duct the latter would have been smaller than a locomotive stack and a greater choking effect would have resulted.

The fans are of the propeller exhaust wall type, without housing and with direct-connected motors. Each

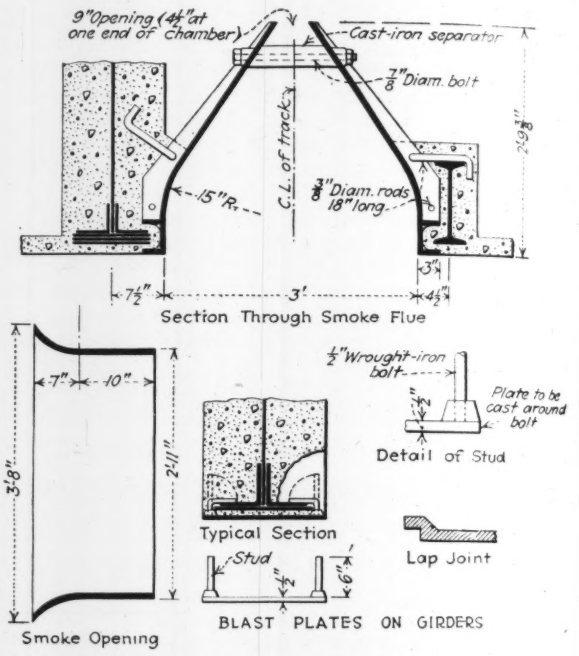


FIG. 3—SMOKE FLUE AND BLAST PLATES

unit is mounted in a 48-in. opening in the outer wall of viaduct, in line with the 36-in. duct, resulting in a very simple construction. This type of fan requires only a low power for a given capacity, but it is not capable of overcoming a high resistance, so that if an extensive duct system were required it would be necessary to use more powerful fans of the full bound centrifugal type. Each of the eleven bays of the final installation will be served by a 48-in. fan with a capacity of 20,000 cu.ft. of air per minute, directly connected to a 2½-hp. alternating-current motor, each unit serving 132 ft. of track. The motors will be controlled by switches at the train gates along the concourse, various schemes of automatic control having been considered and rejected.

Girders extending across the smoke flues are protected by ½-in. cast-iron blast plates on the concrete covering, as shown in Fig. 3. These plates are cast around 6-in. lengths of ½-in. bolts or studs which are hammered down over the bottom chords of the girders.

Cast iron was decided upon as a material for the inlet plates and the 36-in. duct; the motor casing is of cast-iron and monel metal and the fan wheel is of monel metal. The surfaces of the compartments will be given a protective coating to prevent gases from attacking the concrete and getting access to the steel. There is a large amount of condensation, but owing to the intermittent passage of locomotives it is thought that the action of the fan will keep the compartments fairly dry.

One of the fans has been installed in the Jackson St. viaduct and removes a large percentage of the smoke and steam. Since the average velocity is only 200 ft. per minute through a 9-in. opening, 4½ ft. above

top of stack, it is apparent that some smoke will get away, but the downward blast is removed and escaping smoke hangs near the ceiling and is either drawn into other smoke inlets or escapes to the openings in the trainshed roof. There will be six fans in the Jackson St. viaduct and five in the Adams St. viaduct.

This novel smoke-removal system was designed and installed under the direction of J. D'Esposito, chief engineer, and E. Brock, mechanical engineer, of the Chicago Union Station Co.

Effect of Storage of Cement Up to Five Years

Results of Tests of Storage in Large and Small Lots, for Different Times and Varying Conditions of Protection

UNDER the title "Effect of Storage of Cement" the Structural Materials Research Laboratory issued in 1920 its Bulletin 6, giving the results of a series of tests made under the direction of Prof. D. A. Abrams. This has now been revised to include tests for the 2 yr. and 5 yr. periods. No important changes in the original conclusions have been made necessary by the later tests, but the following summary, written to cover the full period of the tests is interesting.

Tests were made in order to determine the concrete and mortar-making properties of three different lots of portland cement which had been stored up to 5 yr. in sacks under different conditions. The cements were purchased from dealers' warehouses and stored in the testing laboratory, in the basement of Lewis Institute, and in a shed in the yard for 2 yr. After 2 yr. all cements were stored in the laboratory. In general the cement was stored in lots of 800 to 1,200 lb. in standard cotton sacks; in one group of tests two brands of paper sacks were also used; in another group the cloth sacks were covered with thin layers of hydrated lime and portland cement. Upon receipt of the cement, and after storage for 3 mo., 6 mo., 1, 2 and 5 yr., concrete and mortar specimens were made for test at ages of 7 and 28 days, 6 mo., and 1 and 2 yr. The tests were begun November, 1916, and completed November, 1923.

This report includes compression tests of about 1,250 6 x 12-in. concrete cylinders, 1,300 2 x 4-in. cylinders of 1:3 standard-sand mortar, and 500 miscellaneous tests.

The following are the principal conclusions from this investigation:

1. The average strength of the concrete (mix, 1:5 by volume, relative consistency 1.00, tested in 6 x 12-in. cylinders, cured in a damp condition) made from the cement as received was 1,470 lb. per sq. in. at 7 days; 3,020 at 28 days; 4,410 at 3 mo.; 4,680 at 1 yr.; 4,910 at 2 yr.; and 6,030 at 5 yr. The increase in strength of concrete with age shown by these tests was approximately proportional to the logarithm of the age, which is characteristic of concrete cured in a damp place.

2. There was an appreciable loss in strength of portland cement due to storage in small lots in sacks for all conditions covered by these tests; the loss was greatest for the cements stored in the shed, and least for those stored in the laboratory. Basement storage was almost as severe as outdoors. The loss in strength was greater for the first 3 mo. of storage than for later 3-mo. periods. For example, the 28-day tests for cement stored in shed showed a loss of about 500 lb. per sq. in. for the first 3-mo. storage and about 250 lb. for the second 3 mo. Still smaller losses were found for later 3-mo. periods. In general the concrete strengths for the cements stored in the shed 1 yr. and longer were about 80 per cent of those for cement stored in the laboratory. The deterioration shown by these tests was probably greater than would be found in a larger lot of cement stored in sacks under similar conditions.

Tests on bin-stored cement now under way have shown an increase in concrete and mortar strength for 4-mo. storage particularly in the 7- and 28-day tests; beyond this time a decrease was found, but up to 1½-yr. storage the strength of the cement had not, in general, decreased below that obtained in the initial tests, which were made only a few days after grinding the cement.

3. The effect of storage of cement was found to be largely a question of the age at which concrete or mortar tests were made. The early tests showed a much greater loss in strength due to storage of cement than tests at later ages. It is of the utmost importance that the strength of the cement was not permanently reduced as shown by the early tests; cements stored in shed for 3 mo. gave an average "strength-ratio" of 73 per cent (as compared to the original strength of concrete) when tested at 7 days, 75 per cent at 28 days and 84 per cent when tested at 6 mo. to 2 yr. Similar relations were found for the other conditions of storage.

4. After storage of cement in shed for 3 mo. the average strength-ratio for the ages at which tests were made was 80 per cent; after storage for 6 mo., 72 per cent; 1 yr., 60 per cent; 2 yr., 46 per cent; and 4½ yr., 45 per cent.

5. Two brands of paper cement sacks gave results which did not differ materially from cloth sacks when used for storing cement for periods up to 4½ yr.

6. Thin covering of portland cement or hydrated lime over cement in cloth sacks showed some advantage, but not sufficient to justify the cost of this method of storage.

7. There was no essential discrepancy between the indications of the compression tests of 1:5 concrete in the form of 6 x 12-in. cylinders and the tests of 1:3 standard-sand mortar in 2 x 4-in. cylinders.

8. The time of setting of cement increased up to storage periods of 1 or 2 yr., and decreased for the longer periods. At the beginning of the tests the initial time of setting was about 4½ hr., after storage for 1 yr. about 7 hr.; for final time of setting the corresponding values were about 8 and 12 hr.

9. The normal consistency of cement was only slightly affected by storage up to 2 yr.

10. It appears that the deterioration of cement in storage is due to absorption of atmospheric moisture, which causes a partial hydration, which in turn, exhibits itself in the lower strength-ratios for concrete, particularly at the early ages.

11. Only a negligible quantity of lumps formed up to 1-yr. storage; these were soft and readily broken. The lumps found in the sacks after storage for 2 yr. and over were generally quite hard; in the shed-stored cements lumps amounted to as much as 30 to 75 per cent of the cement. Lumps were generally discarded before testing the cement.

Concrete and mortar tests of cement and pulverized lumps from cement stored for 7 yr. showed the cement to have about 30 per cent of its normal strength and the lumps 35 per cent of the strength of the cement; in other words the "lump cement" gave 10 per cent of the original concrete strength. For these tests the lumps were pulverized to such a fineness that all passed a 28-mesh sieve and about 45 per cent was retained on a 200 sieve. Earlier tests of broken lumps screened from cement and tested shortly after it was received at the laboratory gave strengths in concrete about 50 per cent of that made with cement from the same sacks.

Standard State Zoning Enabling Act

Within a year of issue of the standard state zoning enabling act, drawn by an advisory committee of the United States Department of Commerce, eleven states had passed acts modeled wholly or in part upon the standard and similar acts had been introduced in four other legislatures. Engineer-members of the advisory committee were the late Nelson P. Lewis, New York City, and Morris Knowles, Pittsburgh. The standard act may be obtained for five cents from the Superintendent of Documents, Washington, D. C.

An Economic Study of Dragline Excavator Operation

I—Output and Cost Records

Performance, Operating Practices, and Costs Determined by Thirteen Million Yards of Excavation for the Miami Valley Flood Protection Works

By C. W. Ullom
Assistant Engineer, Miami Conservancy District, Dayton, Ohio

IT IS BELIEVED that the construction of the flood prevention work of the Miami Conservancy District stands as a record for the number of machines used and for the quantity of material handled on one job by dragline excavators. Twenty-one draglines were used, including Bucyrus, Lidgerwood, Marion and Monighan models, and ranging in size from the small steam-operated, caterpillar-mounted machine with 32-ft. boom and ¾-cu.yd. bucket, weighing about 26 tons, to the large, electrically-operated, truck-mounted machine with 135-ft. boom and 4½-cu.yd. bucket, weighing about 250 tons. In addition, the dragline principle was applied to stiff-leg derricks and other light machines.

Nearly all of the work was done by the District's own forces, thus affording an excellent opportunity for performance and cost records covering a large variety of work. Many of the data presented herewith have been abstracted from the final reports of the several division engineers, acknowledgment of which is hereby made.

TABLE I—DRAGLINE EXCAVATION QUANTITIES ON THE DAYTON CHANNEL IMPROVEMENT

Machine	Class	No.	Total Cu.Yd.	Months	Mo. Average Cu.Yd.
Lidgerwood	K	D-16-8	890,000	28	31,800
Bucyrus	175	D-16-15	2,045,000	47	43,500
Bucyrus	175	D-16-16	1,502,000	46	32,650

For draglines working alone, excavating and casting material:

Machine	Average per Month, Cu.Yd.	Maximum per Month, Cu.Yd.	Average per 10 hr. Shift During Maximum Month Cu.Yd.
D-16-8	31,800	56,400	1,130
D-16-15	43,300	87,500	1,700
D-16-16	40,200	69,100	1,280

Note—The machines work two 10-hour shifts per 24 hours excepting Sunday or 12 shifts per week.

For D-16-16, Bucyrus Class 175, digging and loading scows:	Cu.Yd.
Average quantity per month	19,000
Maximum quantity for one month	55,400
Average per 10-hr. shift during maximum month	1,060
Total quantity scowed	350,000
Average scow load	220 to 225

For D-16-16, Bucyrus Class 175, digging and loading trains:	Cu.Yd.
Average quantity per month	24,500
Maximum quantity for one month	48,800
Average per 10-hr. shift during maximum month	940
Total quantity	85,000

Description of the Work—The channel improvement work at Dayton, Hamilton, and the smaller cities along the river consisted principally of the excavation of material from the channel, down to the official plan grade, and the placing of this material in adjacent levees and spoil banks, as far as local conditions made this procedure possible. At Dayton, about half of the excavated material could not be utilized in levees, and, owing to the close proximity of valuable property through the heart of the city, it was necessary to transport most of the surplus to spoil areas. At Hamilton, a much greater proportion was hauled to spoil areas. Transportation was effected by standard-gage trains with 12-cu.yd. side-dump cars. An added feature of special interest at Dayton was the transportation of approximately 350,000 cu.yd. of material on 40x120x 6-ft. deck scows, towed by a 20x70x3.5-ft. stern-wheel steam tug. Much of the excavation was made from below water, the material being generally sandy loam or fairly uncompacted gravel.

TABLE II—MATERIAL PLACED IN EMBANKMENT BY DRAGLINE D-16-15, BUCYRUS CLASS 175 AT DAYTON

(*Analysis of Field Cost for October*, 1920)

Item	Cost	Cost per Cu.Yd.	Percentage of Total
Labor	$2,851.88	$0.055	42.9
Materials	1,245.24	0.024	18.7
Hauling	82.11	0.001	1.2
Industrial Insurance	59.65	0.001	0.9
Electric Power	976.00	0.019	14.7
Plant charge	1,056.34	0.022	15.8
General expense	389.14	0.008	5.8
Total	$6,660.36	$0.130	100.0

Note—The preceding figures are computed for 51,700 cu.yd. This is for one handling only and includes no overhead charges.

Attendant upon the main features of excavation were many incidental jobs of construction. At Dayton, it was necessary to lay or lower thirteen pipe lines crossing under the river channel. Excavation had to be made for numerous large concrete retaining walls, bridge piers and culverts. Road embankment for street alteration was necessary. These jobs, each comparatively small in itself, aggregated a considerable volume of material handling.

In connection with the construction of each of the five dams forming the retarding basins, excavation was necessary in preparing the foundations for the outlet works, consisting of discharge conduits, and an overflow spillway, or a combination of the two in one structure. Much of this excavation was in rock of Cincinnatian formation, and in pits as deep as 60 ft. below the adjacent land elevation.

The most extensive feature of excavation at the dams was that necessary in securing material for the hydraulic fill in the dam embankment. The material was, in most instances, excavated from borrow-pits in the valley bottom upstream from the dam, loaded on standard-gage trains with side-dump cars, and hauled to the hog-boxes at the toe or on the slope of the dam, where it was dumped. At the hog-boxes the material was mixed with water and pumped into the dam proper. The borrow-pit material was soil for the top two or three feet, the remainder being sand and gravel. The depth of cut was from 10 to 30 ft., about half being below water.

TABLE III—MATERIAL EXCAVATED BY D-16-16, SCOWED TO GRAVEL PLANT, AND PLACED IN STOCK PILE BY D-16-8 AT DAYTON

(*Analysis of Field Cost for December* 1920)

Designation	Quantity Cu.Yd.	Cost	Unit Cost	Per Cent
Excavation by D-16-16	12,180	$2,473.55	$0.203	27.8
Transportation by steamboat and scows	12,180	3,162.82	0.259	35.5
Placing in stock pile by D-16-8	12,180	2,253.52	0.185	25.4
General items	12,180	1,003.70	0.082	11.3
Total	12,180	$8,893.59	$0.729	100.0

In the dam formation, small draglines were used in throwing up small slope levees necessary to prevent successive lifts of the hydraulic placement from overflowing the finished slopes of the dam. Diversion and

cutoff trenches also constituted a part of the excavation program.

Some conception of the quantity of material moved by the draglines, together with unit costs of different classes of work on the various features are given herewith. Where figures are available, average and maximum performances are also given, along with any unusual features of cost that might be of interest.

Dayton Channel Improvement—The total quantity of material moved by the three large machines on the Dayton work, not including quantities in track-fill or work around pipe lines, is given in Table I.

Costs—No cost records were kept for the work done by D-16-16 in connection with trains. The operation was never continuous for long periods and the costs were not considered to have any real value for reference. Carefully kept records are available, however, for the other classes of work. Table II is a typical monthly analysis of the field cost of excavating material and placing it directly in embankment. Table III is a similar analysis of the field cost of excavating material, transporting by scows, and placing in spoil bank by another machine. In comparison, figures obtained from the records of the accounting department and shown in Table IV contain *all* items chargeable to the work done and are based on *total* yardages handled, including estimated quantities of trackfill.

TABLE IV—CHANNEL EXCAVATION AT DAYTON, COST OF DRAGLINE OPERATION, ONE HANDLING

Item	D-16-8 for 7 Months Ending Aug. 31, 1922	D-16-15 for 16 Months Ending Aug. 31, 1921	D-16-16 for 16 Months Ending Aug. 31, 1921
Labor	$14,576.56	$37,171.79	$37,314.58
Supplies	1,093.56	2,435.55	7,331.21
Minor repairs	1,176.92	6,613.39	4,137.07
Fuel and power	3,976.94	16,586.17	15,772.43
Cable	1,753.74	3,770.43	4,768.52
Miscellaneous	105.64	355.28	161.04
Depreciation	1,750.00	17,010.00	18,305.96
Total	$24,434.36	$83,942.61	$87,790.81
Work done cu.yd.	299,050	981,989	641,510
Cost per cu.yd.	$0.082	$0.085	$0.137

Note—D-16-8 worked with 100 ft. boom and 2½ to 3½ cu.yd. bucket.
D-16-15 worked with 125 ft. boom and 3½ to 4½ cu.yd. bucket.
D-16-16 worked with 135 ft. boom and 3½ to 4½ cu.yd. bucket.

The total cost of excavating and disposing of all materials, either in levees or spoil banks, from the river channel at Dayton was $1,367,082. The pay quantity of excavation was 2,146,474 cu.yd. and the unit cost per cubic yard, $0.637. In the disposition of this pay quantity approximately 4,437,000 cu.yd. of material were handled, equivalent to the handling of each cubic yard of channel excavation slightly over two times.

Hamilton Channel Improvement—The excavation of the river channel at Hamilton was similar to that at Dayton, with the exception that the greater part of the material was transported to spoil-banks by train haul. About 2,200,000 cu.yd. of material were excavated from the river channel by dragline excavators. During the five months from June to October, 1921, the dragline D-16-18, Bucyrus, Class 24, electrically operated, equipped with 100-ft. boom and 3½-cu.yd bucket, excavated from the channel and loaded on cars 378,000 cu.yd. or an average of 75,600 cu.yd. per month. Table V is an analysis of the cost of excavating and disposing of materials by train haul, for a period of four months during 1921, showing also the percentage of labor to total cost. The digging during this period was straight-away work with cuts varying from 5 to 12 ft. The total cost of excavating and disposing of all material from the channel at Hamilton up to Dec. 31, 1922, was $1,425,973, the total pay quantity 2,186,682 cu.yd. and the unit cost $0.652 per cubic yard. It is interesting to note the small variation in unit cost between this and the costs of $0.637 and $0.633 at Dayton and Troy respectively. The work at Troy was smaller in quantity and simpler in character and was done under contract. The force account unit costs at Dayton and Hamilton compare very favorably with the contract cost at Troy.

Dam Construction—The total quantity of mixed earth and rock excavated by the draglines in connection with the construction of the outlet works at the five dams was 1,229,000 cu.yd. The average cost was $1.06 per cubic yard including hand trimming of slopes, drilling, blasting and disposing of materials by train haul. The quantity performance at each dam, together with the unit cost, is given in Table VI.

The draglines were used at three of the dams in connection with train haul for excavating material from borrow-pits in the valley floor and conveying to hog-boxes for sluicing into the dam proper. At the other two dams the borrow-pits were so situated that it was possible to break down the material with hydraulic giants, and sluice it by gravity to the pump sumps. The total quantity excavated by draglines and loaded on cars at the three dams was 5,061,000 cu.yd. and the cost per cubic yard was approximately $0.09.

TABLE V—COST OF EXCAVATION BY BUCYRUS CLASS 24 ELECTRIC DRAGLINE. DISPOSITION BY TRAIN HAUL AT HAMILTON
June to September, 1921

Items	Excavation	Transport	Track	Dumping	Miscellaneous	Total
Labor	$17,846.83	$18,364.48	$22,028.90	$5,595.23	$4,202.43	$68,037.87
Depreciation					17,268.96	
Power					4,021.19	
Shop orders					3,237.89	
Garage charges					1,330.89	
Materials and supplies					21,888.31	
Supervision and accounts					4,338.24	
Miscellaneous					2,206.32	
						54,291.80
Total						$122,329.67

Total quantity 296,398 cu.yd.			
Labor	$68,037.87	$0.23 per cu.yd.	56 per cent
Other expense	54,291.80	0.18	44 per cent
	$122,329.67	$0.41 per cu.yd.	100 per cent

TABLE VI—DRAGLINE PERFORMANCE AND COST EXCAVATION FOR FOUNDATIONS OF OUTLET WORKS

Dam	Type of Machine	Quantity Earth	Quantity Rock	Cu.Yd. Total	Cost per Cu.Yd.	Aver. Month	Max. Month
Taylorsville	Lidgerwood M-Electric	482,352	236,100	718,452	$0.95	19,950	38,150
Englewood	Bucyrus-24 Steam	16,096	52,934	69,030	1.50	9,600	16,740
Huffman	Bucyrus-24 Electric	39,400	142,600	182,000	1.64	20,000	26,604
Germantown	Lidgerwood K-Electric	68,000	40,000	108,000	1.12	9,000	16,500
Lockington	Lidgerwood K-Electric	100,950	50,568	151,518	0.68	11,650	30,600
Total		706,798	522,202	1,229,000	$1.06	15,900	38,150

The quantity and cost performance at each dam is given in Table VII.

At Taylorsville, the Lidgerwood Class M dragline excavated 110,000 cu.yd. of earth from the inlet channel and cast the material onto the hillside for sluicing at a cost of $0.18 per cubic yard.

At Lockington, the Lidgerwood Class K dragline excavated from side borrow and cast directly into dam embankment, 195,915 cu.yd. of earth at a cost of $0.23 per cubic yard.

Table VIII is a typical analysis of the cost of excavating material from borrow-pit by dragline covering the total period of operation at Huffman dam.

The total yardage handled by the larger draglines on

all of the major operations in connection with the flood prevention work was therefore:

	Cu.Yd.
Dayton channel	4,437,000
Hamilton channel	2,200,000
Troy channel	218,600
Dam outlet works	1,229,000
Dam borrow-pit work	5,061,000
Dam miscellaneous work	305,915
Total	13,451,515

Miscellaneous Costs—The following costs are given as of interest in the operation of draglines.

A Lidgerwood Class K electric dragline was employed at Dayton on the construction of the South Broadway bridge approach. The embankment had a total length of 2,150 ft., a 30-ft. top, side slopes of 1½ to 1, and a height of fill from 0 ft. at one end to 24 ft. at the other. The material was obtained from a borrow-pit alongside and was all placed by the machine with one handling. The total amount of 26,000 cu.yd. was placed in embankment at a field cost of about $0.11 per cubic yard.

TABLE VII—DRAGLINE PERFORMANCE AND COST, BORROW-PIT EXCAVATION

Dam	Type of Machine	Excavation Earth, Cu.Yd.	Cost per Cu.Yd.	Aver. Month	Max. Month
Englewood	Two, Bucyrus 24 steam and electric	3,401,000	$0.083*	110,000	180,000
Huffman	One, Bucyrus 24 electric	1,060,000	0.105	54,500	70,610
Germantown	One, Lidgerwood K-electric	600,000	0.115	50,000	70,000
Total		5,061,000	$0.091	54,000	90,000

* Figures available for eight month period only.
Note—Unit costs do not include transportation of material after loading.

A portion of the embankment for the relocated Ohio Electric Ry. was built by two stiff-leg derricks, converted into draglines. The total volume thus handled was 65,000 cu.yd. and the unit cost, including the cost of rebuilding the derricks, amounted to $0.296 per cubic yard. This work is described in greater detail in *Engineering News-Record*, Jan. 15, 1920, p. 151.

The cost of dismantling a Bucyrus Class 175 electric dragline, hauling the parts by truck 3¼ miles through the streets of Dayton, and re-erecting was $7,820.57.

The cost of a similar procedure with a Lidgerwood Class K electric dragline, except that the haul was only 2½ miles, amounted to $3,666.45.

At Hamilton, the field cost of unloading from cars and erecting a Bucyrus Class 24 electric dragline was $3,309.47. The similar cost on a Bucyrus Class 14 caterpillar-mounted, steam dragline was $1,572.72.

The cost of supplies and repair parts on a Bucyrus Class 24 electric dragline at Hamilton during the year 1921 was $9,170.05, and shop work on the machine during the same period amounted to $2,433.51. Similar costs on a Bucyrus Class 14 caterpillar-mounted, steam-operated dragline were $3,290.37 for supplies and repairs and $1,016.53 for shop work.

The cost of electric power, as given in Table IX, is for current only, furnished by the Dayton Power & Light Co. in all cases except at Hamilton, where it was furnished by a local company. The rate charged is dependent upon maximum demand and volume of current consumed. The figures given do not include all of the features, only those where authentic records were available being used.

Comparison of Steam and Electric Draglines—Of the 21 draglines used on the District work, in nine the motive power was electricity, while in the remainder it was steam. Thus an unusual opportunity was afforded for comparing the relative merits of the two sources of energy. An article in *Engineering News-Record*, Jan. 19, 1922, p. 96, gives a detailed comparison of two machines of the same make and type, one steam and the other electric, under similar operating conditions, for a period of four months at Englewood. Unit costs for the steam and electric machines were $0.0753 and $0.0643 per cubic yard respectively, and the yardages handled 277,000 and 283,000. The main item of difference in the cost of operation was the labor saved on the electric machine. In the comparison heretofore mentioned, it was noted that for the four month period the cable cost on the electric machine was about twice that on the steam machine. The records of cable cost covering the whole construction period show very little difference in cost between the steam and electric machines. The experience on the whole of the District work is decisively in favor of the electric machine. It has been found cheaper, less troublesome, cleaner and more free from breakdowns, in general more efficient.

TABLE VIII—EXCAVATING MATERIAL WITH DRAGLINE FROM BORROW-PIT AT HUFFMAN DAM—ANALYSIS OF COST

Item	Detail: Per Cent of Total	Detail: Cost per Cu.Yd.	Total: Per Cent of Total	Total: Cost per Cu.Yd.
Labor			38.3	$0.400
Direct	36.3	$0.038		
Absorbed (operating and overhead)	2.0	0.002		
Industrial insurance			9.8	0.001
Supplies			9.1	0.010
Direct	7.5	0.008		
Absorbed	1.6	0.002		
Electric power			15.3	0.016
Plant			16.9	0.018
Shop and garage services			8.4	0.009
Direct	8.1	0.008		
Absorbed	0.3	0.001		
Camp depreciation			9.0	0.009
Miscellaneous			2.2	0.002
Total			100.0	$0.105

Note—The machine used was a Bucyrus, Class 24, electrically-operated, equipped with 100-ft. boom and 4½-cu.yd. bucket.

TABLE IX—COST AND CONSUMPTION OF ELECTRIC POWER USED ON ELECTRIC DRAGLINES

Job	Type of Machine	Kw.-Hr. Per Cu.Yd.	Cost per Kw.-Hr.	Cost per Cu.Yd. of Excavation
Hamilton	Bucyrus Class 24	1.347	$0.0183	$0.0246
Germantown	Lidgerwood Class K	0.650	0.0175	0.0115
Huffman	Bucyrus Class 24	0.650	0.0182	0.0120
Englewood	Bucyrus Class 24	0.855	0.0185	0.0159

[*A second article, on operating methods and costs of dragline excavator operation, will appear in an early issue.*—EDITOR.]

A California Concrete Arch Bridge

A large concrete arch bridge is to be built across Van Duzen River near Alton, Humboldt County, Calif., by the state highway commission to replace an old steel structural on the Redwood Highway. Bids have just been asked. The bridge will comprise three 163-ft. arch spans and a number of short approach spans, and will provide a 21-ft. roadway. The arches are of the barrel or single-rib type carrying a slab floor by means of columns spaced about 10 ft. apart. The arch ribs are 14 ft. wide and range from 2 ft. thick at the crown to 3 ft. 3 in. at the skewbacks. The structure was designed to carry two 15-ton trucks and a uniform load varying from 70 to 130 lb. per square foot, increased by an impact percentage for all parts of the structure except piers and abutments. Customary unit stresses were used, the concrete compression being raised from 650 to 750 lb. per square inch when temperature stresses are included.

Salt Water Climbs the Locks of The Panama Canal

Up-Lockage Brings Sea Water Into Miraflores Lake —Tests of the Salinity—Conditions Controlling the Increase

By R. Z. Kirkpatrick
Chief Hydrographer, The Panama Canal

THE IDEA that salt water would climb the Miraflores lock flight of the Panama Canal was not considered possible at the time of construction; instead it was assumed that the heavier salt water would lie as a bottom stratum in the lower lock. For this reason the water from Miraflores Lake was used for the industrial and domestic supply of the village on the Pacific side and for Panama City.

However, after lockages started, it soon developed that the chlorine content of Miraflores Lake was rapidly increasing (see *Engineering News*, Nov. 26, 1914, p. 1088). The source of municipal water supply was then changed to a point on the Chagres River arm of Gatun Lake at Gamboa, and a series of tests was made to determine the progress of this interesting development.

The Pacific end of the canal is at sea-level, a salt-water canal, eight miles long; north of this are the two-flight, twin Miraflores Locks, leading to Miraflores Lake, at Elevation 54, above mean sea level; one mile across Miraflores Lake is the one-flight, twin Pedro Miguel Lock, leading to the Gaillard Cut section and Gatun Lake at Elevation 85. Miraflores Lake has an area of 1.6 sq.mi.

The tests were made at Miraflores Locks to determine the chlorine content of water in the lock chambers during the successive stages of raising a barge from tide to lake level. The results are illustrated diagrammatically in the accompanying figure. Sea water may be considered as containing 20,000 parts of chlorine in a million; ordinary fresh water, 5 to 10. The samples were taken at the bottom, middle, and top of the lock chamber water both before and after the horizontal and vertical movements of water incident to an up-lockage. At the beginning of the experiment, immediately after the lower gates were opened, a strong current set up in the lower level, fresh water going out and salty water coming in. Before the lower gates were opened (referring to the figure), the lower level salinity was uniform top and bottom; afterward the range of chlorine was from 12,300 on top to 20,000 p.p.m. on the bottom. When the level was equalized with the upper lock level the violent "mushrooming" of the water upward through the lock floor manholes gave a thorough mix of chlorine content, top and bottom.

As the routine of the lockage and changes of levels continued, the trend was as described above, the chlorine content decreasing by dilution steadily upstage. It is seen from Sections VII, VIII, IX and X, that an increment of chlorine gets into the lake in each up-lockage; and it was assumed at that time that eventually Miraflores Lake would become virtually salt, with some brackishness in Gaillard Cut via Pedro Miguel Locks.

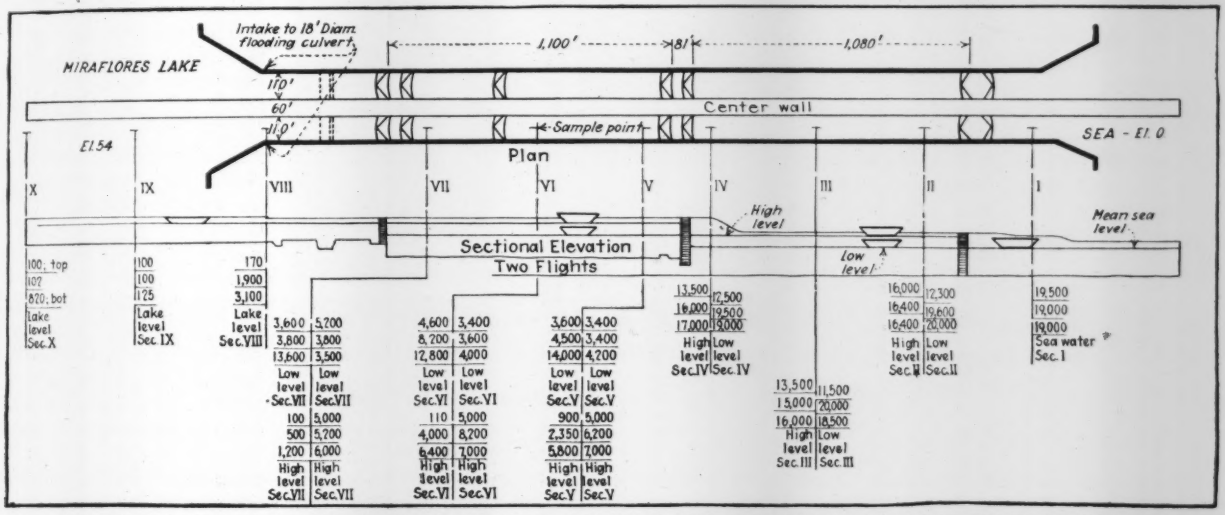


DIAGRAM OF MIRAFLORES LOCKS SHOWING CHLORINE CONTENT OF WATER DURING AN UP-LOCKAGE
Figures give chlorine content of water in parts per million; samples taken at top, mid-depth, and bottom of lock chamber.

Miraflores Lake has a maximum monthly inflow of 350 sec.-ft. from its 38.5 square mile watershed during the wet season (May-December). In the dry season there is virtually no inflow from its watershed. However, each down-lockage from Pedro Miguel Locks brings about 3,000,000 cubic feet of fresh water that helps in reducing the salinity. Excess water is drawn off the lake by periodic spilling at Miraflores spillway. It follows that the lake would be saltier in the dry season (January-May), when virtually no watershed inflow or spilling occurs.

Record samplings of the Miraflores salinities have been made continually since 1914 with the exception of from 1917 to 1919 inclusive. It appears that the lake is generally less salty than in 1915; and it has been found that the Gaillard Cut salinities had not materially increased.

It seems that salinity does not increase in proportion to the number of lockages. On the contrary, there is a resultant decrease in the rate of increase of the salinity. It is likely this is due to the following: When a Miraflores up-lockage occurs, it brings up some salt water. If there are many transits a day, this

heavy water (which must pass the intakes of 18 ft. diameter flooding culverts) has not time to get disseminated over the neighboring fresh water in the lake before the next down-lockage of over three million cubic feet occurs. The salty water is caught in the culverts' suction and largely drawn back into the lock chambers. Also, many lockages a day means much Gatun Lake fresh water drawn through Pedro Miguel Locks. This water in turn has current toward Miraflores, hence is continually repulsing the northward advance of the salt water, again allowing it to be sucked back into the Miraflores Locks, and the lower sea-level section.

The Panama Canal experience may well be noted, where a lock is to be built that will connect salt and fresh water, if partial chlorination of the fresh water will be detrimental. A partial palliative for the chlorination tendency is to construct siphon culverts alongside the flooding culverts; they should be operated after each up-lockage, emptying into the sea. These siphons should head from horizontal openings in the forebay floor in front of the upper mitergate sill; their carrying capacity should be such as to carry the salt-water residuals back to the sea, before the latter have diffused into the fresh water. All of this, of course, is at the expense of water supply, hence will not be practical in many cases.

Slim Pneumatic Caissons Penetrate Stone-Filled Crib

By Careful Work 57 Caissons Were Sunk 45 ft. Through Riprap, in 70 Days, Some as Close Together as 12 in.

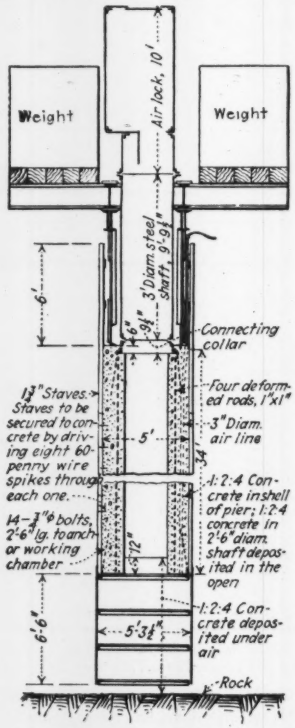
BY C. S. RINDSFOOS
Secretary-Treasurer, Jarrett-Chambers Co. Inc., New York, N. Y.

SEVERAL factors give interest to the foundations recently completed for the new grain elevator for the state of New York at the barge canal port of Oswego. The work was prosecuted with practically no delay during the winter months although located in a section where severe weather is the rule and on a site exposed on all sides. It is instructive also in that it illustrates the possibility of sinking caissons very close together, in some cases the clearance being only one foot. Mainly, however, it is interesting to note the despatch with which the piers were sunk by the pneumatic method as compared with the difficulties encountered, on an adjoining site under a previous contract, where a similar group of foundation piers were installed in the open by the use of steel sheetpiling.

The new elevator is located on a pier which is 150 ft. wide and which juts out into the harbor a thousand feet or more. This pier had been made previously by placing two rows of rock-filled cribs between which was deposited riprap and other fill. The surface of this pier is some 9 ft. above the water level and the rock lies some 36 ft. below water. Hence the sinking of the foundation piers involved the penetration of an average of 45 ft. through the worst kind of material and it was for this reason that, in the light of the difficulties which had been met previously with the piers sunk in the open, pneumatic caissons were adopted.

The foundation design called for the installation of 57 circular concrete piers of which 24 were 4 ft. 6 in. in diameter and 33 were 5 ft. in diameter. The method employed by the contractor for building and sinking these piers is illustrated herewith. A steel working chamber of the proper diameter and 6 ft. 6 in. high was first set up at each location. Over the working chamber was molded a reinforced-concrete shell with a 2 ft. 6 in. diameter hole or shaft-way in the center. Wooden lagging was used to form both the outside and inside of this shell, the outside form being left in place and sunk with the caisson, the inside form being eventually removed.

The contract for these foundations was not awarded till early fall and the first working chambers arrived and were set up the first part of November. As it was evident that freezing weather might be expected at any time, the work of setting up the chambers and concreting the shells was pushed vigorously and practically no sinking, other than some ditching to render the piers stable, was done during this period. All of the building up and concreting of all the piers was thus completed by Christmas, so that from that time, when air was put on, the job was reduced to one of sinking only and hence was immune to cold weather.



PNEUMATIC CAISSON PIER FOR GRAIN ELEVATOR

This procedure is not the one customarily used in a job of this sort. It is commonly considered good practice to build and sink caissons progressively, on the theory that there is then less chance of one caisson pulling another out of position and this would be the more likely to happen where caissons are as close together as they were here. Moreover the tops of the air locks were about 50 ft. above the ground and this was considerable in proportion to the diameters and made it so much the more imperative that the ground around one caisson should be undisturbed by another. However, in order to render the work independent of the cold weather and snow that were imminent, it was decided to build up all in the manner described and depend on skill in sinking to maintain them plumb and is position.

After air pressure was applied the sinking proceeded without difficulty other than that naturally to be expected in going through material containing a large quantity of riprap and boulders. The 57 piers were sunk in 70 working days or four piers every five days.

The caissons were designed and sunk by Jarrett-Chambers Co., Inc., of New York City, the work in the field being in charge of M. M. Tiernan. James Stewart & Co., Inc., are the general contractors and the entire project is under the supervision and control of the New York State Department of Public Works.

Four Activated-Sludge Plants in California

Various Systems of Air Distribution Used Include Perforated Pipes and Trent Aerator on Barker Mill Principle

By C. E. Grunsky, Jr.
Consulting Engineer, San Francisco, Calif.

SEWAGE TREATMENT by means of the activated-sludge process has made progress in California in spite of the fact that scattered population in the West renders sewage disposal a less urgent problem than in regions in which the population is comparatively dense. Four full-scale plants have been constructed in the state—at Folsom prison, in 1917; Turlock in 1920; Lodi in 1923; and Pasadena in 1923-24. These plants differ widely in the methods of air distribution that have been adopted.

Folsom—The first full-scale activated-sludge plant in California was built in 1917 at Folsom prison near the town of Folsom. It served a total population of about 1,350. The sewage is strong in character and will average about 130,000 gal. daily. Accurate flow measurements are not made. Air is obtained from a large compressor located in the main power plant of the prison and no record is kept of the amount of air used at the sewage works. The plant was built with the aid of convict labor and is operated by convicts, therefore construction and operation costs are not of value for comparison.

The aeration tank is of reinforced concrete, 41½x 24 ft. in plan and 9 ft. deep. Wooden baffles divide it into eight 4⅞x24-ft. compartments, so interconnected that sewage entering the tank must travel forward and back across the tank for a distance of 100 to 200 ft. before its discharge into the settling tank. The aeration tank has a sawtooth bottom. The valleys are 18 in. deep with slopes of 45 deg., and with the crests 7½ ft. below the top of the tank. The valley troughs are 3 ft. apart, making eight to each compartment or 64 in all. Air is admitted to the bottom of each valley through perforations in a short length of ¾-in. pipe.

The activated sewage is discharged from the aeration tank through five stop-plank gates into an air channel which in turn discharges over one of its side walls into the settling tank. The settling tank is 40x10 ft. in plan. It is divided by concrete walls into four 10x10-ft. compartments, having hopper bottoms 10⅜ ft. deep at the center and 1⅜ ft. near the walls, giving slopes about 1 ft. horizontal to 2 ft. vertical. A redwood plank baffle 3½ ft. deep runs parallel to and about 2 ft. from the side wall of the tank over which the activated sewage is received.

Each compartment is provided with an air lift and the sludge is elevated to a flume which returns it to the head of the aeration tank. The effluent from the settling tank passes over an adjustable brass weir into a small flume which conveys it to a chlorine contact or mixing flume at the head of which hydrochlorite of lime is added. The chlorinated effluent travels 75 ft. in this contact flume in which distance the thorough mixture of effluent and chemical takes place.

At this plant, the procedure is to return to the head of the aeration tank all the sludge until a sample taken near that point indicates 60 per cent sludge content. When this condition is attained, a large part of the sludge is removed by pumping the sludge from the settling tanks and from the first compartment of the aeration tank to the sludge-drying beds. During this period the first compartment of the aeration tank is bypassed.

By means of a 3-hp. motor and No. 3 centrifugal pump the sludge is forced several hundred feet through a pipe to a small sludge thickening tank 10x10 ft. in plan from the surface of which the clear liquid is decanted before discharging. The sludge flows by gravity from this tank to four 25x25-ft. sludge-drying beds separated by 4-in. concrete walls. The beds consist of 4 in. of sand on 8 in. of gravel, with 4-in. drain tile in the bottom of the gravel layer. The liquid drained from the sludge is chlorinated before discharge into the river.

The aeration tank has a surface area of 1,000 sq.ft., a volume of 8,000 cu.ft. or 60,000 gal. per acre per 24 hr., and a detention period, when the sludge content has reached 50 per cent, of 6 hr. The sedimentation or settling tank has an area of 400 sq.ft. and a capacity of 2,000 cu.ft. or 15,000 gal. Under existing conditions this means a rate of sedimentation of 325 gal. per square foot of surface area per 24 hr. and a detention period in the settling tank of 2¾ hours.

The aeration tank has greater volume than is prescribed by current practice in which filtros blocks are used to distribute the air. The bubbles of air, as observed at the surface of the tanks at Folsom, are rather coarse and the aeration unevenly distributed throughout the mass of liquid. Both the effluent and dried sludge are odorless and permanent in character. The quantity of air used is undoubtedly very large but as the compressor is operated by electricity produced at the main power plant of the prison by water power, the cost of compression is not of great importance.

Apparently the Folsom plant is giving complete satisfaction. As yet no market has been found for the sludge.

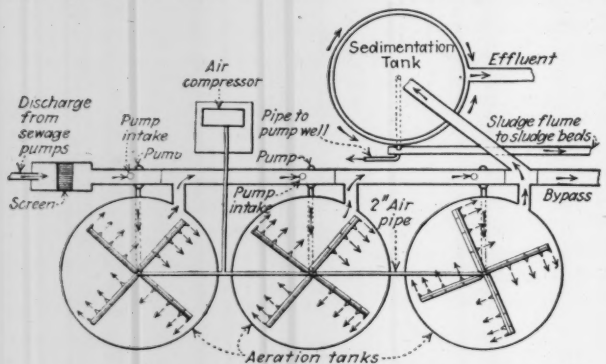
Turlock—During the year 1920, a full-scale activated sludge plant was constructed at Turlock, a community which is the center of a thriving agricultural district in the San Joaquin valley. The present population of Turlock is estimated at 5,000 and the maximum flow of sewage is said to be at the rate of 1,200 g.p.m. or about 1.7 m.g.d. In view of the limited extent of local manufacturing industries, it is believed that the probable dry-weather flow does not exceed 0.75 m.g.d. Of this amount about 0.6 m.g.d. is treated by the activated-sludge process and 0.15 m.g.d. goes to a septic tank 20x60 ft. and 8 ft. deep built several years ago and now inadequate.

Sewage from the main outlet sewer mixed with return sludge from the sedimentation tank flows through a ½-in. mesh basket screen into a pump well around the top of which are three horizontal centrifugal pumps. The pumped sewage and return sludge pass through an inclined screen composed of ⅛x1½-in. bars spaced ⅝ in. apart, placed in a 24x24-in. redwood flume leading to the aerating tanks.

There are three cylindrical aeration tanks operated in series. Each is of redwood, 30 ft. in diameter and 20 ft. high, equipped with a Trent aerator. The aerator consists of revolving arms of the Barker-mill type equipped with nozzles submerged in the tank to

near its bottom. A mixture of sewage and air is forced through the arms and out of the nozzles—of which there are a number on each arm—in a direction at right angles to the radial arms in such a manner as to cause rotation to the device. The air is obtained from a No. 1 Nash Hytor compressor, which has a rated capacity of 90 min.-ft. of air delivered against 10 lb. pressure and is brought over the top of the tanks, down the hollow central stem, and, by means of a small auxiliary pipe, is mixed with the sewage just before it enters the nozzles and is ejected into the mass of sewage in the tank.

A No. 6 centrifugal pump located at a level below the bottom of each aeration tank forces the sewage



LAYOUT OF ACTIVATED-SLUDGE PLANT AT TURLOCK

and air into the tank through the nozzles on the rotating frame, causing the agitation of the sewage. The discharge from each tank is over the top by flume into the 6-in. suction pipe of the centrifugal pump located at the next tank.

The aeration observed was not efficient. Many large bubbles of air were noted and ebullition was violent in parts of the tanks, with relative quiescence elsewhere. No facilities were available for measuring the air or the pressure under which it was delivered.

From the third aeration tank the sewage flows through a flume to a conical-bottomed sedimentation tank 25 ft. in diameter, with a depth of 6½ ft. at the periphery and 12 ft. at the center. It is equipped with a Dorr thickener.

The results obtained at this plant do not appear satisfactory. The sludge and effluent are foul smelling but because of the use of the effluent on a sewage farm below the plant, the septic condition has not yet proven an intolerable nuisance. From the figures obtained insufficient aeration and short circuiting seem to be the main causes of the trouble at this plant. The lack of depth in the sedimentation tank also figures in the poor results obtained.

Lodi—During 1923 an activated-sludge plant has been constructed at Lodi, a town of 8,000 inhabitants that is the center of an agricultural district and has increasing manufacturing industries. Two weeks after the inflow of sewage into one unit of the plant in November, 1923, observation indicated that satisfactory results could be expected.

In design this plant follows the practice at certain larger Eastern sewage-works. Reinforced concrete is used throughout. Nash blowers supply the air and filtros plates in precast concrete trays are used to distribute it. The bottom is of the sawtooth type with a

SUMMATION OF PLANT DATA—TURLOCK

Quantity of sewage treated daily...	= 600,000 gal. (estimated dry flow).
Volume of aeration tanks (3).....	= 42,000 cu.ft. = 300,000 gals.
Rate of aeration treatment.....	= 12,000,000 gal. per acre daily.
Quantity of air furnished.....	= 0.2 cu.ft. per gal.
Volume of sedimentation	= 3,760 cu.ft. = 28,000 gal.
Rate of sedimentation tank.....	= 1,250 gal. per sq.ft. per day.
Detention period, aeration.....	= 7 hours (assuming average of 25% sludge).
Detention period, sedimentation....	= 54 min. (assuming 25% sludge).
Capacity of circulating pumps.....	= 1,100 gal. per min.
Capacity of Nash Hytor.....	= 90 cu.ft. per min. free air to 10 lb.

diffusion ratio of about 1 to 4. Dorrco rotating screens are used to remove the coarse suspended and floating solids before the sewage is pumped to the aeration tanks. Each of the four aeration tanks is 124 ft. long, 12 ft. wide and 17 ft. deep with a 2-ft. freeboard. Two 30-ft. Dorr clarifying tanks receive the discharge from one aeration unit of two tanks. The sludge is lifted from each clarifier by an air lift and discharged into an aerated return-sludge channel 6 ft. wide and 18 ft. deep, one for each clarifier, which runs parallel to and between the aeration tanks back to their inlet ends. It is intended to mix with the incoming raw sewage enough sludge to bring the sludge (at 98 per cent water content) to about 25 per cent by volume of the activated sludge.

Air is obtained from three No. 4 Nash Hytor compressors, each driven by a 30-hp. motor, and from one No. 7 Hytor compressor driven by a 100-hp. motor. The rated capacity of the air plant is 2,400 min.-ft. against 10 lb. pressure.

The total connected load at this plant amounts to 247 hp. of which 190 hp. is used to operate the air compressors. The plant is designed to handle about 2 m.g.d. with a 6-hr. aeration detention period, and it is understood that it cost approximately $150,000.

It is to be hoped that C. F. Smith, the engineer who designed this plant, will sometime describe this plant and its operation in some detail.

Due to the sawtooth bottom of the aeration tank and the arrangement of the filtros plates eddy currents and reversed flows of considerable importance are set up in the tank, as in all similar installations, resulting in short circuiting. Undoubtedly a considerable portion of the sewage which reaches the outlet has received much less than 6 hr. digestion in the tank. An arrangement of the rows of filtros plates longitudinally in the tank, so as to cause a movement or rotation of the liquid in a plane at right angles to the length of the tank, would reduce the tendency to short circuit.

Pasadena—The Pasadena activated-sludge plant, in the design of which R. V. Orbison, city manager, has taken a leading part, was practically completed early this year, but delay in the delivery of the special pipe that is to be laid in the floor of the blower house delayed putting the plant in operation. This plant will exceed in size the other plants now operating in California.

An entirely satisfactory method for distributing the air still remains to be found. In some preliminary experiments recently made to determine the quantity of air that could be drawn into the suction pipe, emulsified with water in a centrifugal pump and then discharged at the bottom of a tank of liquid, it was found that by using a No. 4 centrifugal pump with a

special runner (rated capacity of 400 g.p.m. of water) about 7 min.-ft. of free air could be entrained and emulsified with the water when operating the pump at 1,200 r.p.m. against a pressure on the discharge side of 6 lb. per square inch. The pump discharge was greatly reduced, owing to the admission of air, and the efficiency was low.

The resulting aeration, when using submerged revolving discharge pipes in a small cylindrical tank 8 ft. in diameter, was very complete, the bubbles obtained being remarkably small and causing a mist to rise to a height of 4 or 5 in. on top of the water. The distribution of air to all parts of the tank was excellent but the power necessary to supply an emulsion of air and liquid containing enough air even to approximate the air found to be necessary for sewage treatment when filtros plates are used was so great as to appear prohibitive.

Some modification of methods thus far suggested for emulsifying the sewage with air before introduction into the tank, and for recharging the sewage with air by enforced circulation and re-emulsification, may yet be found. Experiments along this line are worth while, as they may show that less air will be required.

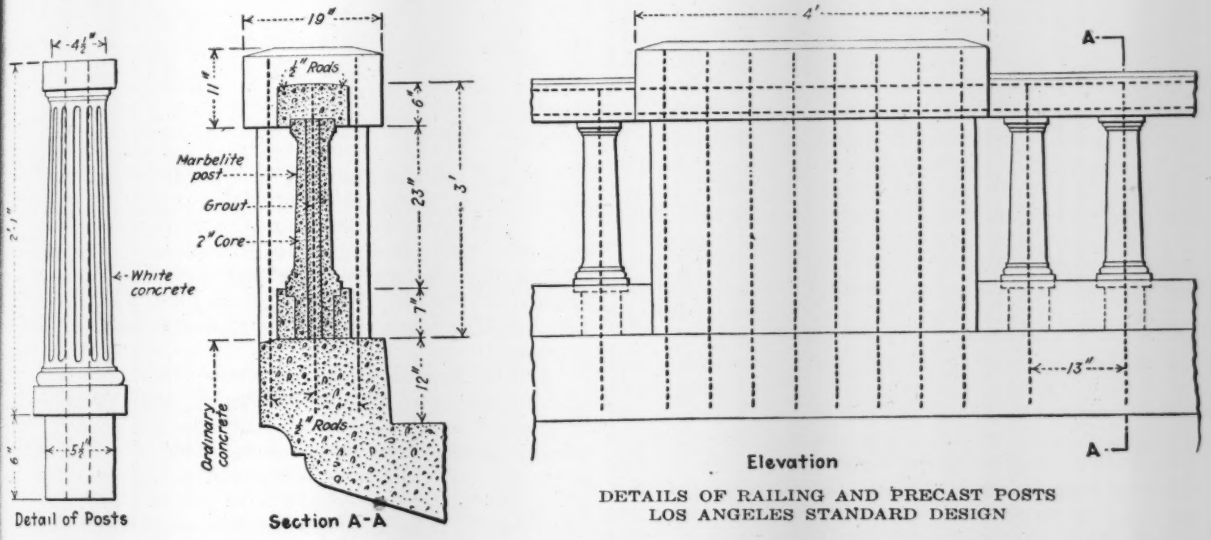
Holes and Pits in Rochester Steel Water Mains

The 38-in. steel water supply conduit for Rochester, N. Y., laid in 1893-94, first disclosed serious pits or holes in 1901. Since that date a total of 1,260 holes have been found and repaired over the entire 26-mile length of the conduit. In 1922 twenty holes were repaired; in 1923 twenty-eight, and up to April 22 of the present year five. From time to time long stretches of the conduit have been uncovered, the old coating scraped off, and the surface then cleaned and recoated. Whei spots or pits are found which appear to extend nearly through the pipe, repairs are made by means of steel patches on the outside and sheet lead underneath, both held in place by steel bands bolted around the pipe. Holes all the way through are plugged with wood before the patches are put on. On the 37-in. lock-bar steel pipe twelve pits have been repaired this year. For the information given we are indebted to B. C. Little, superintendent of water-works, Rochester, N. Y.

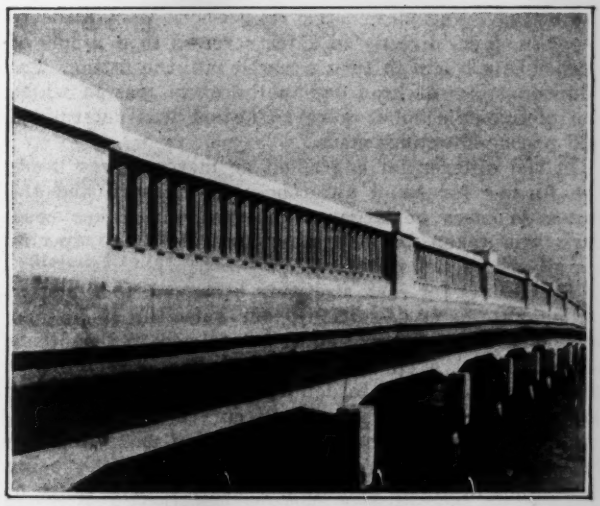
Bridge Railing with Precast Posts Adopted as Standard

THE LOS ANGELES (Calif.) Highway Commission has adopted as standard a concrete bridge railing with precast posts. The concrete is a 1:2:3 mix made with white Medusa cement, white Monterey sand and white quartz gravel. The materials cost only $1 per cubic yard more than those ordinarily used and save in maintenance, improve appearance and add safety.

The intermediate posts or uprights, which measure 2 ft. 8 in. overall and 1 ft. 9 in. from base to capital, are precast under contract. The castings are made in aluminum forms, which, when filled with the concrete, are placed in a lathe and revolved at 500 r.p.m. for several minutes to secure a maximum density at the surface. The posts are cured under water two weeks.



DETAILS OF RAILING AND PRECAST POSTS
LOS ANGELES STANDARD DESIGN



GENERAL VIEW OF WHITE STANDARD RAILING

In putting them in place they are slipped over ½-in. reinforced rods previously set 13 in. apart in the concrete of the bridge proper and left projecting through the 6-in. base of the railing. The 2-in. core is then grouted, and the handrail is poured in wood forms.

Tests of Loss of Head in Standard Elbows and Tees

Four Sizes of Small Fittings Set in Pipe Fed by Calibrated Tank and Provided With Piezometer Connections

BY LYNN PERRY
Department of Civil Engineering, Lafayette College, Easton, Pa.

IT IS NOT unusual to see lines of standard pipe, particularly around oil refineries and industrial plants, containing an unnecessarily large number of connections. Frequently the velocity of the material flowing through these pipes is very high. To determine the exact loss of head, and consequently of energy, when a stream of water is passing through lines of pipe containing standard connections, has been the object of investigations recently conducted in the hydraulic laboratory at Lafayette College.

Standard 1-, 1½-, 2½-, and 3-in. elbows and tees were used in the four different size pipe lines. The discharge was measured by permitting the water to flow into a carefully calibrated tank. The total amount discharged was divided by the time of flow in seconds, giving Q, which, when divided by the area of the cross-section of the pipe, A, gave the mean velocity, V. From this relation, $Q = AV$, the velocity of each run was computed. Overflows were used to maintain a constant head on the pipe containing the fitting, a constant head being necessary to maintain a constant velocity.

The lost head was measured in each case by making piezometric connections to differential gages. Particular care was taken to have these connections just flush with the inside of the pipe. These connections were made 4 to 7 in. above and 6 to 8 in. below the fitting for the 1½-, 2½- and 3-in. sizes. Most uniform results were obtained with connections located a minimum of 4 in. or twice the diameter above and a minimum of 6 in. or three times the diameter below the fitting, the greater distance below being because of the contracted section of the vein after passing through the fitting. The piezometric connections were made to the 1-in. pipe, directly to a tee screwed to a nipple of proper length and in turn screwed into the fitting. The additional loss of head due to the extra tees to which the piezometric tubes were connected was determined and proper allowance made.

In the differential gages, oil or mercury was used; the former for small differences in pressure and the latter in cases of larger differences. In either case, care was taken to determine accurately the specific gravity before using.

The results for each size were arranged, then plotted on logarithmic cross-section paper, velocities in feet per second as abscissas and the loss of head in the fitting as ordinates. A curve (straight line) was then drawn through these points to determine the loss of head for intermediate velocities. These curves have been assembled in Fig. 1, the actual range of measurements being indicated by a solid line, the broken lines being extensions to higher and lower velocities. The range of actual observations covers normal working velocities.

Fig. 1 shows the following values of H for the different sized elbows: $.016v^2$ for a 1-in.; $.014v^2$ for 1½; $.011v^2$ for 2½; $.010v^2$ for 3-in.

H represents the loss of head and v indicates the velocity of the water in each instance. Most text-books

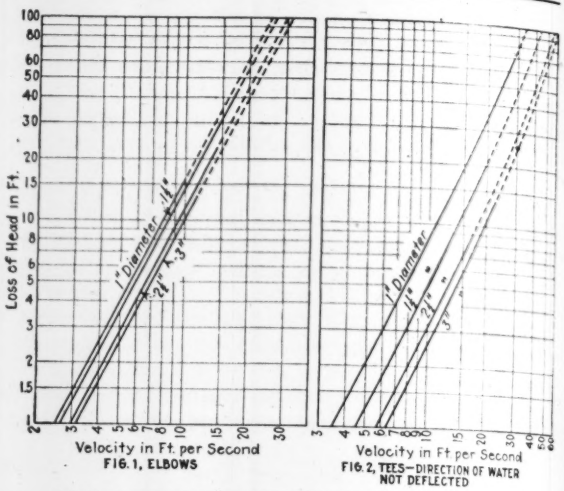


FIG. 1, ELBOWS FIG. 2, TEES—DIRECTION OF WATER NOT DEFLECTED

LOSS OF HEAD IN STANDARD NEW ELBOWS AND TEES

Size, In.	Elbows: Number of Runs	Elbows: Velocity Range Ft. per Sec.	Tees: Number of Runs	Tees: Velocity Range Ft. per Sec.
1	46	1.152 to 11.26	41	1.16 to 10.85
1½	39	1.568 to 14.06	27	2.68 to 19.61
2½	39	1.403 to 16.36	25	2.12 to 17.08
3	31	0.822 to 9.78	17	1.77 to 12.20

state that the lost head due to a bend or elbow may be computed by using the formula $H = k(v^2 \div 2g)$, where k is a constant to be determined by experiment and varying with the size and physical condition of the fitting. These observations indicate that $k = 1.04$ for a 1-in. elbow; .91 for 1½; .71 for 2½; .64 for a 3-in. elbow, in all cases for new wrought-iron pipe with standard screw fittings.

Similar investigations have been made for standard tees in the same sizes as for elbows, when the water is flowing through the tee and not deflected through 90 deg. These observations were made with the same care and with the same equipment as those for elbows. The results have been similarly averaged, plotted and correlated. Fig. 2 shows the loss of head for various velocities, plotted on logarithmic cross-section paper.

The values of H for these curves are: $.0084v^2$ for a 1-in. tee; $.0050v^2$ for 1½; $H = .0031v^2$ for 2½; $H = .0025v^2$ for a 3-in. tee; H and v representing the lost head and velocity respectively. The corresponding constants k in the formula $H = k(v^2 \div 2g)$ will then be .54 for a 1-in. tee; .32 for 1½; .20 for 2½; .16 for a 3-in. tee.

It is not surprising that considerable head is lost when a stream of water is deflected 90 deg. with a standard elbow. The fact that loss of head is so great in passing through a tee connection with no deflection in flow makes it worth while to measure the exact head lost in other standard pipe connections.

CO Protective Liquid Found Ineffective

A liquid compound claimed to reduce the risk of carbon monoxide poisoning in automobile garages and similar places and widely marketed on this claim was recently subjected to test by the Bureau of Mines, and found worthless. A. C. Fieldner and W. P. Yant, reporting on the test in an information circular just issued by the Bureau, prepared 0.30 per cent and 2.5 per cent mixtures of carbon monoxide and air to which the liquid compound was then exposed for periods ranging from several hours to a month. In the gas over the liquid no decrease of carbon monoxide was detectable.

Regional Highway Traffic Problem of New York City

Physical Survey Discloses Conditions Forecasting Traffic Development Calling for Belt Roads and City Entrances

By Ernest P. Goodrich and Harold M. Lewis
Consulting Engineer and Executive Engineer, Respectively, of Committee on Regional Plan of New York and Its Environs

Extracts from a paper presented at the conference on traffic at New York, May 20, under the direction of the committee on Regional Plan of New York and Its Environs.

A BROAD investigation and survey of all the factors that influence the growth and prosperity of the communities within the metropolitan region of New York and its environs attempted, as a first step, to obtain adequate information regarding physical features. The physical survey included a detailed study of the past and present distribution of population; the preparation of many maps and diagrams showing the existing physical conditions and their relation to all methods of communication and to public and semi-public facilities, such as recreation and sanitation; and the collection of data setting forth the numerous and varied proposals for the improvement of conditions. This survey, carried out under the able direction of the late Nelson P. Lewis, largely completed its original program several months ago. The engineering staff then entered upon a more detailed study of the existing facilities for road communication and plans for their improvement.

Physical Conditions Affecting Highways—The area being studied includes 5,528 sq.mi. and in 1920 had a population of about 9,000,000. The distribution of this population varies from 2,284,000 in Manhattan, with a resultant density of 104,200 people per square mile, to 10,800 for Putnam County, with a density of only 45 persons per square mile. The topography greatly complicates the development of a suitable system of radial and connecting highways. The entire area is cut almost in two by the Hudson River, and Long Island Sound effectually isolates all of Long Island from highway connection with the rest of the territory, except by passing through the congested parts of New York city. A series of hills and ridges, running diagonally across the northwestern part of the district and reaching an elevation of over 1,600 ft., permits easy grade arterial routes only at certain quite distant points. In eastern Westchester County and that part of Fairfield County, Connecticut, included, the irregular topography and large number of streams running north and south make difficult the development of additional inland highways parallel to Long Island Sound. As a result of these conditions a map of the principal improved roads in the territory shows a very tangled network, but it has been possible to evolve the elements of an existing system of trunk line highways.

There is in existence a large number of well defined arterial routes and three quite complete circumferential highways which can be reduced to a theoretical diagram, Fig. 1. In order to form a picture of the maximum load being carried by the principal arterial highways, a plan, Fig. 2, was drawn showing the maximum hourly traffic as computed from available statistics and as shown by twenty-seven new counts made by the engineering staff during the summer of 1922. These latter counts indicated clearly that the maximum hourly traffic on arterial routes leading to and from the central congested area occurs during the latter part of Sunday afternoons during the summer months. Traffic at this time may vary from 150 to 200 per cent of the maximum hourly traffic on the Saturday preceding. It is obvious, therefore, that it is pleasure traffic which determines the necessary capacity of such highways.

The maximum hourly traffic indicated on the map prepared occurs on the Boston and Albany post roads near the New York city line and the Lincoln Highway in the city of Elizabeth, the traffic at these points reaching a total of 1,400 to 1,600 vehicles per hour. There is a very acute situation on Long Island highways near the city line, where there was a count of about 1,300 vehicles per hour on the Merrick Road and the other principal radial highways carried traffic varying from 1,035 to 1,105 vehicles per hour.

Motor Vehicle Registration—In New York City alone there were in 1923 about 265,000 passenger cars, 79,000 motor trucks and 20,000 omnibuses. There has been comparatively little change in the proportion of each of these during the past few years. There were in the entire city about 45 persons per motor vehicle in 1916, and in 1923 this figure had been reduced to about 16 persons per vehicle, while those for the different boroughs varied from about 9 to 20 persons per vehicle. It appears that in 1930 there will be about 8 persons per motor vehicle, or a total in New York City of about 835,000 vehicles based upon an estimated population of 6,700,000.

There were in the environs about 7 persons per vehicle in 1923 in contrast with 16 in the city itself. For the entire area this figure has decreased from about 35 in 1916 to 11.1 in 1923. An estimate of future registration indicates a total of 2,180,000 motor vehicles in 1930, of which about 38 per cent will be within New York City and 62 per cent in the balance of the area. Assuming a ratio of 3½ persons

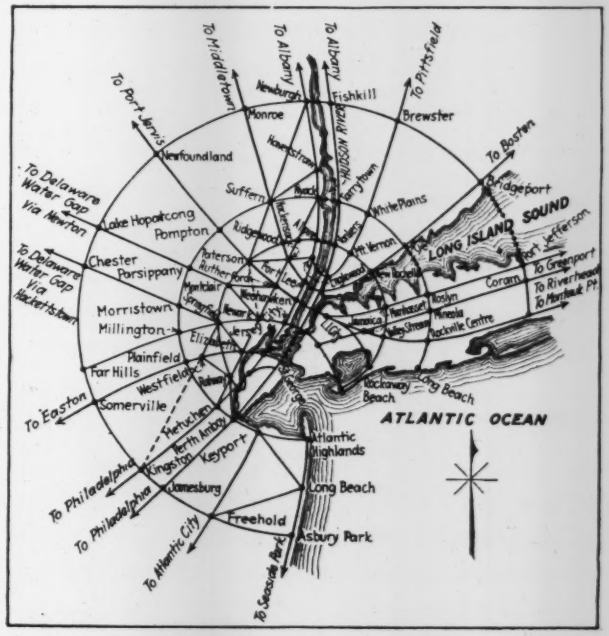


FIG. 1—THEORETICAL DIAGRAM OF MAIN HIGHWAY ROUTES IN NEW YORK DISTRICT

per vehicle in 1960 this would mean that in that year with the estimated population of 19,000,000, there would be 5,430,000 motor vehicles registered within the entire area, or 35 per cent of the total United States registration for the year 1923.

Motor Vehicle Accidents—While quite complete statistics are available for New York city, there are no accurate statistics of accidents for the whole of the New York region. In order to arrive at a reasonable estimate of the number within this region, a relation has been established between registration and motor vehicle fatalities. Statistics were plotted for New York City, New York State, and the United States, over a series of years, and it was found that the relation between fatalities and registration is shown in the following equation:

$$\text{Number of Fatalities} = 0.73\ (\text{Registration})^{\frac{3}{4}}$$

It may be safely stated from this equation that there were in the New York and environs area in 1923 about 2,030 fatalities from motor vehicle accidents. With an estimated registration of 2,180,000 vehicles in 1930 it is probable that there will be 4,100 fatalities during that year.

Congestion in New York City—No regional highway study can be made without very careful consideration of that part of Manhattan Island which now forms the center of the highway system. The day population of Manhattan

south of 59th St. has been defined as the number of persons which would be within the area within those two or three hours of the day during which most of the business is concentrated. Diagrams, Figs. 3 and 4, have been prepared showing the number of persons and vehicles which it is estimated will enter this same area during 24 hours on a typical business day in 1924, and showing their distribution on the various avenues of approach. The results obtained indicate a total daily movement of persons into the area of 2,849,600, and a total daily movement of vehicles of 223,450. It appears that 47.5 per cent of the number of persons come from the area to the north, 39.1 per cent from Brooklyn, Queens and the rest of Long Island, 12 per cent from New Jersey and 1.4 per cent from Staten Island. The corresponding figures for the vehicles are 59.4 per cent from the area to the north, 25.9 per cent from Brooklyn, Queens and the rest of Long Island, 13.6 per cent from New Jersey and 1.1 per cent from Staten Island.

Measures of Relief—Efficient municipal administration would obviously expend funds for relief of traffic congestion in proportion to the losses involved. While no careful estimates have been made, as far as known, with reference to points within the New York region, some idea can be secured with reference to probable losses by comparison with other municipalities where such estimates have been carefully made. In Worcester, Mass., it amounted to $35,000 per day. In Cincinnati studies indicated that approximately $100,000 per day was the cost of the congestion. In Chicago $200,000 per day is approximately the figure reached. Judged by the total amount of traffic in these various communities compared with New York, it would seem safe to estimate the cost of congestion in Manhattan Island at $500,000 per day, and the cost in the whole region to approximate $1,000,000 per day.

The means for regulating traffic in the less congested

FIG. 2—MAXIMUM TRAFFIC DENSITY AS OF 1922 ON MAIN ROADS TO NEW YORK

parts of the area have not been well developed and there is undoubtedly considerable opportunity for improvement. This would consist not only in small physical changes to direct the lines of traffic at important intersections and the installation of automatic signals, but in some cases the actual rerouting of vehicles. One of the simplest methods of providing increased traffic capacity is by the segregation of various types of traffic so as to permit freer movement along the individual routes. This could be carried out along two lines—first, by the segregation of through and local traffic, second, by the segregation of trucks and passenger vehicles.

The segregation of trucks and passenger vehicles has in the past generally been made by the restriction of certain parkways and boulevards to passenger vehicles only. It is probable that in addition to such restrictions there will eventually have to be highways which are intended for trucks only and which passenger vehicles would either naturally avoid or from which they would be excluded. A new type of segregation which has been tried in a few instances is that by types of motive power. For instance,

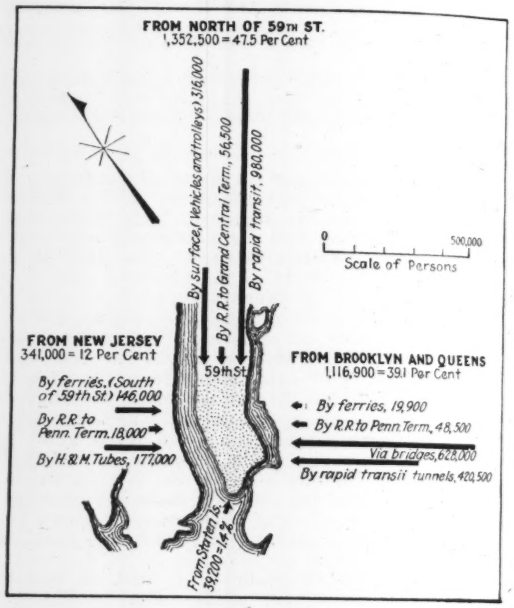

FROM NORTH OF 59TH ST.
1,352,500 = 47.5 Per Cent
By surface (Vehicles and trolleys), 376,000
By R.R. to Grand Central Term., 56,500
By rapid transit, 980,000
0 500,000
Scale of Persons
FROM NEW JERSEY
341,000 = 12 Per Cent
By ferries, (South of 59th St.) 146,000
By R.R. to Penn. Term. 18,000
By H. & M. Tubes, 177,000
59th St.
FROM BROOKLYN AND QUEENS
1,116,900 = 39.1 Per Cent
By ferries, 19,900
By R.R. to Penn. Term., 48,500
Via bridges, 622,000
By rapid transit tunnels, 420,500
From Staten Is. 39,200 = 1.4%

FIG. 3—PERSONS ENTERING MANHATTAN BELOW 59th ST.

on the East River bridges no horse-drawn vehicles were permitted on one bridge so as to provide possibilities for higher speed on the part of passenger vehicles. In that instance the horse-drawn vehicles were diverted to another bridge.

It might be possible to increase the stringency of segregation in the direction of securing better use of present facilities by the enactment of ordinances for the promulgation of police regulations, whereby pleasure cars which contained only one or two passengers could be detoured to less frequented thoroughfares, even where such detouring involved a considerable extra mileage, thus providing additional facilities for passenger vehicles like trolley cars and motor buses, each of which could carry from ten to twenty times as many passengers as could the pleasure automobile. In a somewhat similar manner itinerant vacant taxicabs might be prohibited from operating on most of the north and south avenues in Manhattan, such cabs being assigned space on regular stands where they could be secured by prospective passengers, while they could also be permitted to operate on cross streets and the less frequented and more distant north and south thoroughfares.

Causes of Congestion—The causes of traffic congestion in Manhattan include: (1) Narrow streets inherited from former times; (2) building heights too great for the capacity of the adjacent streets; (3) the lack of zoning with reference to use, height and bulk of buildings, so as to preclude the creation of traffic congestion caused by the use of the streets by such building tenants, especially at morning, noon and evening hours; (4) the lack of platting ordinances which would prevent the creation of new subdivisions with streets which are too narrow for their ultimate use; (5) the inadequacy of arterial thoroughfares both present and proposed; (6) the lack of a comprehensive plan within which can be included each of the several creative and preventive measures suggested above.

Summary of Problems—The studies being made of the highway traffic problem in New York and its environs are not yet complete but they have progressed far enough to show those main elements of the problem which have been

referred to in this paper and also to give some indication of the most important specific projects which should receive very careful consideration. Many of these must be planned primarily by the local communities in which they occur, but all local plans should be related to a general plan of the whole region. The following list is offered as an indication of those which are being studied by the committee and as a suggestion to the various municipalities within the area.

A. Arterial and Circumferential System for Entire Area

1. A bypass route north of the congested part of Manhattan Island to connect New Jersey with the mainland of New York State east of the Hudson River.
2. A new highway inland from the existing Shore Road in Monmouth County, to provide more direct access from northern New Jersey to the shore resorts.
3. The necessary legislation and adoption of a program to make possible the eventual development of a parkway route along the Morris Canal west of Paterson.

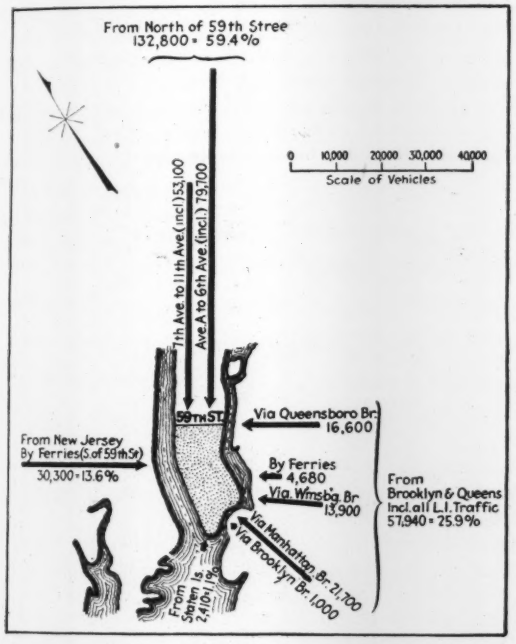


FIG. 4—VEHICLES ENTERING MANHATTAN BELOW 59th ST.

4. A new route to provide better connection from Bridgeport and Norwalk to the Hudson River—Bear Mountain Bridge.
5. The development of a parkway system west of the Hudson River, corresponding to that being developed by Westchester County on the east, which will connect the Palisades Interstate Park with the Essex County Parkway system via the Saddle and Passaic River valleys.

B. Exits and Entrances to Metropolitan Center

1. Development of new arterial routes on the southern part of Long Island, which will help to relieve congestion on existing highways and provide connections with Brooklyn which will bypass congested points in that borough and the borough of Queens.
2. An additional general traffic route parallel to the Boston Post Road between New Rochelle and Bridgeport.
3. The adoption of a program which would provide for a future parkway route from Southern Westchester County to Bridgeport.
4. A circumferential route from the proposed Hell Gate bridge, borough of Queens, to the vicinity of Fort Hamilton, Brooklyn, bypassing congested districts and including Kings Highway.
5. Extension of Riverside Drive to connect with existing roads in Yonkers, with a diagonal connection to the proposed Tibbetts Brook Parkway.

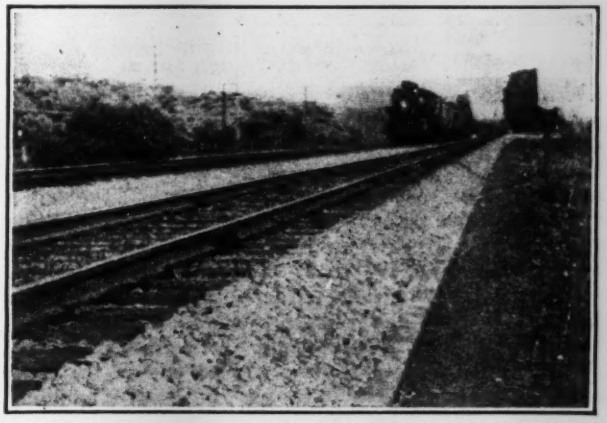
C. Borough of Manhattan

1. Removal of obstructions in north and south avenues so as to increase their present capacity.
2. Development of new routes along the Hudson and East River waterfront for through traffic.
3. Development of a highway along the Manhattan side of the Harlem River to connect the north and south avenues and make them more available for through traffic.

Ballast Toe Curb Installed on Southern Pacific Line

WORK is in progress on the entire mileage of the Southern Pacific Lines to place a stone curb or toe line at the edge of the roadbed ballast. This construction has been in trial use for a number of years; experience has shown it to be so useful that it has now been made standard practice. Its purpose is to improve the standard of maintenance both of the ballast and of the subgrade. The photograph herewith illustrates the appearance and construction of this curb.

Primarily the curb line creates a fixed working line to which the edge of the ballast bank is to be maintained. It is an incentive and guide to careful work on the part of the section men. Besides promoting neat appearance of the roadbed, it tends to keep the ballast to full cross-section by giving the foot of slope a definite location. It facilitates inspection (and thereby reacts on the quality of the work of the section gangs) by enabling the inspecting officials to see even from a fast-moving train whether the roadbed is well maintained or is neglected.



BALLAST TOE CURB ON SOUTHERN PACIFIC

View on main line south of San Francisco, where curb is made of quarry blocks; on some sections of line cobbles are used.

In addition, the curb provides a telltale on subgrade conditions. Any settlement, slumping or washing is made readily apparent. The line furnishes a guide to the section men in keeping up the shoulders of the embankment, and thus will improve subgrade maintenance in the same way as ballast maintenance.

The material of the curb is either cobbles or trap or granite blocks of small paving-block size. The blocks are set into the subgrade flush with its surface and are tamped into position.

Electric-Hydraulic Dredge Work on Illinois Levees

Material Pumped to Enlarge Levee and Fill Borrow Pits—Special Cutter on Suction and Shutters on Discharge Pipe

ENLARGING a levee and filling its old borrow pits by means of an electrically-operated hydraulic dredge is the method adopted for protecting the Hartwell Levee and Drainage District, as a result of the Illinois River flood of 1922, which caused a breach of about 150 ft. in the levee. Although the old levee failed after being overtopped by the flood, the present engineers for the district concluded that the borrow pits were probably a source of weakness. For this reason it was considered desirable not only to raise the crest 2 ft. but to place sufficient additional material on the inside slope to fill the old borrow pits. The amount of material required for this enlargement is about 347,000 cu.yd. and up to March, 1924, about 275,000 yards had been placed. Measurements are made in the fill for payments on yardage in place. To insure a good bond, the top and rear slope of the levee are thoroughly plowed and scarified before the new material is deposited. The levee cross-section, Fig. 1, shows the work that is being done.

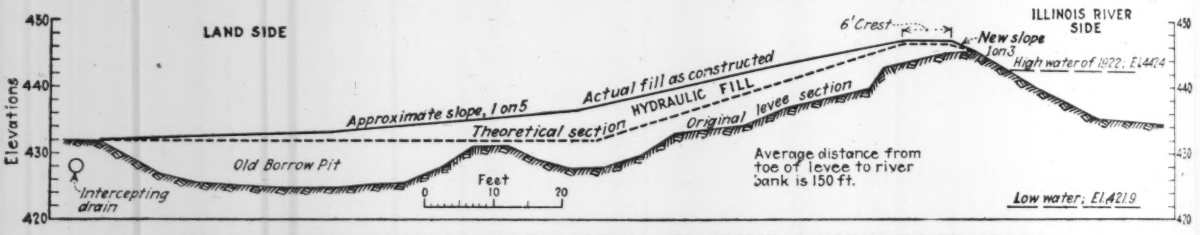


FIG. 1—ILLINOIS RIVER LEVEE ENLARGED AND ORIGINAL BORROW PITS FILLED

This drainage district, near Hillview, Ill., with an area of about 11,000 acres and 12.2 miles of levee, has a frontage of five miles on the Illinois River. Along this frontage the levee is protected by a belt of trees or timber averaging 150 ft. in width and extending between the levee and the river. Internal drainage is taken care of by an electrically operated pumping station, described in *Engineering News*, Sept. 23, 1915, p. 581, which is said to have proved one of the most economical plants along the river in cost of pumping per acre. There are three 30-in. centrifugal pumps driven by electric motors of 150 hp. and giving a nominal capacity of 67,500 gal. per minute.

It was decided to enlarge the levee by pumping material from the Illinois River, which parallels the levee at a distance of 200 to 500 ft. For this purpose a 15-in. hydraulic dredge was built, and as an abundant supply of electric power was available from a 33,000-volt transmission line of the Central Illinois Public Service Co., it was decided that the dredge should be electrically driven. Since the sand of the river bed at this point is overlaid and mixed with strata of silt and clay, a plain suction type of dredge would not handle the material and it was considered necessary to equip the dredge with a digging ladder and open-type rotary cutter of special design. Boulders have caused some trouble in clogging the pipe, and deposits of shells have occasionally cut the rubber sleeve connections on the floating discharge pipes. The proportion of solid matter in the discharge varies considerably but the engineer of the district gives an average of 14 per cent. Approximately 50 per cent of this material is sand, the remainder being mixed mud and shells. It takes a slope of about 1 on 5.

On account of the swift current in the river, a line of pontoons composed of steel cylinders was used as best adapted for carrying the 15-in. discharge pipe. Posts mounted on these pontoons carry the electric cables to the dredge from a transformer barge moored at the shore to step down the current to 2,200 volts. The material is deposited in the levee by means of the shutter pipe method (Fig. 2), in which certain sections of the discharge pipe have bottom openings fitted with sliding gates (see *Engineering News*, Oct. 29, 1914, p. 891, and July 27, 1916, p. 158). With the dredge about 200 ft. from the levee, the pontoon line is about 500 ft. long, while the length of the discharge line on shore is from 300 to 1,200 ft. The average pumping distance is about a thousand feet.

This dredge is designed to dig to a depth of 30 ft. below water line, to pump heavy sand and gravel through 4,500 ft. of pipe, and to deliver this material at an elevation of 20 ft. above water line. The hull, built on the river bank of heavy Oregon fir timbers, is 80x24 ft. and 6 ft. deep, with a draft of about 3½ ft. All planking is 14 in. wide, 8 in. thick for bow and stern, 6 in. for the sides, 4 in. for the bottom and 3 in. for the deck. The deck beams and cross-beams are 6x8 in., spaced 36 in. c. to c. Two continuous longitudinal bulkheads built of 6x14-in. timbers extend the full length of the hull.

A 15-in. dredging pump is directly connected to a 500-hp. variable-speed induction motor, the speed range being from 350 to 514 r.p.m. according to the head against which the dredge is operating. Three pump runners of different diameters are also provided, so that by installing the runner most suitable to the length of discharge pipe the motor can be run at nearly full speed and therefore with maximum efficiency. The pump thrust bearing is of the marine horseshoe type, and runs in an oil bath. The motor is of the enclosed type and with its covers removed to allow additional ventilation it is capable of carrying continuously a load of 600 to 700 hp.

A structural steel ladder with I-beam side members, 45 ft. long, is mounted on heavy cast-steel trunnions at the bow and has its outboard end supported from an inclined steel boom or A-frame. The 15-in. suction pipe is fastened beneath the transverse members of the ladder, while above these members is mounted the shaft of the cutter which revolves in front of the suction pipe opening. This cutter, shown in Fig. 3, is 57 in. in diameter, of the open type, with six renewable

blades of manganese steel. It is driven at a speed of about 17 r.p.m. by a 50-hp. motor on the dredge, power being transmitted to the cutter shaft on the ladder by a heavy cast-steel universal joint. The gears in this cutter driving mechanism are cast steel with cut teeth.

Two 54-ft. spuds of Oregon fir, 20 in. in diameter and shod with cast-iron points, are fitted to cast-steel guides at the stern. One of these spuds is used as a pivot about which the dredge swings while working, and the other serves as a "walking spud" to advance the dredge and keep the cutter close to the face of the cut. A five-drum hoist mounted on the deck, forward of the pump, has one drum to raise and lower the ladder, two to operate the swinging lines and two to operate the spuds. This hoist is driven by a 37-hp. variable-speed motor, with double compound gearing to the drums in order to give a high rope pull at low speed, which is necessary in dredge work. Two motor-driven centrifugal pumps of 1½-in. and 3-in. diameter provide for priming the dredging pump and for general service work respectively. The electric light equipment includes searchlights and floodlights.

Rubber sleeves connect the pipes on the dredge with the suction pipe on the ladder and the floating discharge pipe, and similar sleeves connect the 32-ft. lengths of discharge pipe on the pontoons. Each pontoon is composed of two 24-in. steel cylinders supporting a timber frame on which are laid the pipe and a plank footwalk. Since the pontoon line has to be held in a swift current, the cylinders of the first pontoons carrying the

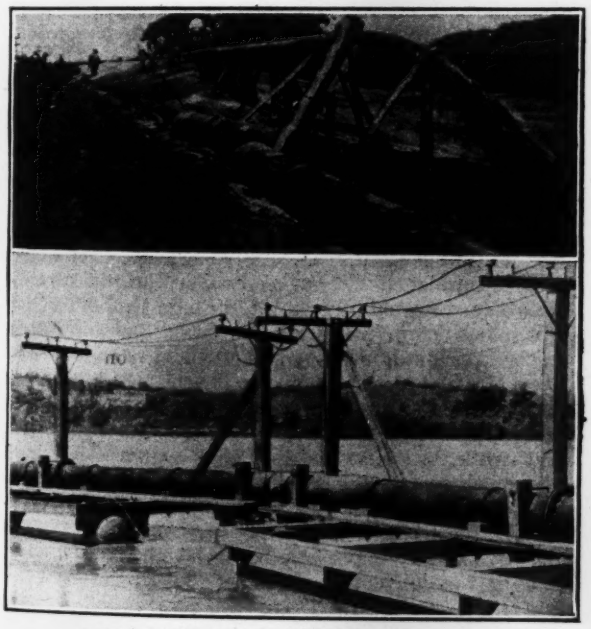


FIG. 2—HYDRAULIC-FILL LEVEE WORK
Above: discharge on levee, showing pipes with bottom gates. Below: discharge pipe on pontoons; each pontoon carries independent section of power line to dredge.

pipe out from the shore are at right angles to the pipe, while those on the portion extending upstream to the dredge are parallel with the pipe. In this way practically all the pontoons have their cylinders in the direction of the current.

On each pontoon are three posts with crossarms to carry the electric wires. Each pontoon has an independent section of the wires mounted permanently, brass connectors being used to connect up the wires on adjacent pontoons. Thus, whenever a pontoon is added to or removed from the line, it carries its own

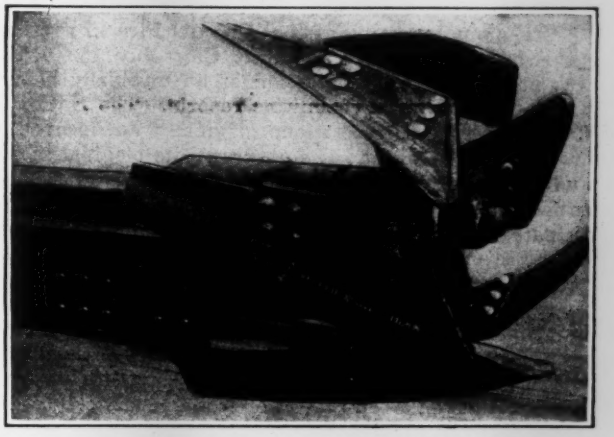


FIG. 3—CUTTER FOR ILLINOIS RIVER DREDGE

wires, and there is no such disarrangement as would be involved if continuous wires were used.

All operations of the dredge are controlled by one man in the pilot house on the upper deck, from which he has an unobstructed view. There is a captain in command, and on each shift the crew consists of four men on the dredge and four to eight men on shore. The crew also includes launchmen, cooks and helpers. Since the work is carried on by day and night in two 10-hour shifts, sleeping quarters are provided on the dredge for the chief operator and chief electrician, so that they are always within call in case of emergency. The balance of the crew are quartered in a two-story house-boat. Work is done on six days of the week.

This hydraulic dredge was designed by Jean M. Allen, consulting engineer, Chicago, who also supervised the hull construction and machinery erection by the forces of the McWilliams Dredging Co., Chicago, which company has the contract for the Hartwell levee. The Caldwell Engineering Co., Jacksonville, Ill., is engineer for the Hartwell Drainage and Levee District.

"Gas-Concrete" Developed in Sweden

A light concrete susceptible of sawing, planing and nailing has been developed by Axel Eriksson, a Swedish architect, according to a report in the *Schweizerische Bauzeitung* of March 8. It is made with cement and shale lime, together with a small addition of aluminum or zinc powder, which upon tempering the mass with water develops hydrogen in contact with the lime hydrate. This makes the mortar porous, in which condition it sets. With a mortar containing 40 parts of cement to 60 parts by weight of the lime, at 75 per cent porosity, the concrete weighs 40 to 50 lb. per cubic foot, and attains a compressive strength of 350 to 400 lb. per square inch after six weeks. The material is resistant to weathering and fire attack in satisfactory degree for use in wall masonry (except chimneys). The building authorities of Stockholm have approved the material for use in walls of one- and two-story dwellings in thicknesses of 6 to 8 in., at working stress not exceeding 43 lb. per square inch.

Progress in Fire-Protection

National Fire Protection Association Discusses Oil Tank Dangers, Safety to Life and Pier Protection

THE annual meeting of the National Fire Protection Association, held at Atlantic City May 13 to 15, was notable for the completion of an unusually heavy program of technical committee reports. The National Fire Protection Association, originally an insurance organization has long since outgrown its original scope and now functions as a fire prevention engineering society in the work of which many varied interests participate, the industries affected having representation on the several committees and taking active part in the preparation of regulations which are likely to affect them when subsequently incorporated in state or municipal legislation or made the basis of insurance requirements. It includes also a large class of members whose primary interest in the association lies in furthering its public spirited work of reducing the fire waste through public education.

Reorganization Proposals—In the report of the Executive Committee there was a suggestion for the establishment of a technical class of membership, to be for fire protection engineers what the other recognized technical societies are for other branches of engineering. This matter was presented for discussion on the floor of the meeting without any definite recommendation by the committee. No very definite sentiment either for or against the proposition was shown by the majority of the members. Of those speaking, one group favored the establishment of the technical membership, advancing in its support the arguments which may be urged in favor of any technical society. Another group seemed to feel that to draw a line between the engineering and the lay members might tend to destroy the spirit of harmony which now so thoroughly permeates the work of the association, without sufficient compensating advantages, for as a matter of fact the association already actually functions as an engineering society, although not so organized. The view was also expressed that many of the fire protection engineer members already have technical society connections. The final action was a vote to make no change in the present organization of the association.

Plans were approved at the meeting for the extension of the field work of the association with the employment of a field secretary. A generous response was received to the appeal for contributions for this purpose.

The National Fire Protection Association, with dues of only $10 and no initiation fee, operates on a total budget of less than $50,000 a year, an amount felt by many members to be ridiculously small in comparison with the work accomplished. Several members suggested the desirability of increasing the dues rather than soliciting contributions to augment the funds but no such increase was seriously considered.

Private Fire Supplies—The relation between water supplies and fire protection was brought out in the address on "The Co-operation of the Water-Works Men in Fire Protection" by George W. Fuller, retiring president of the American Water Works Association. Mr. Fuller's address was followed by the presentation of the report of the Committee on Private Fire Supplies from Public Mains of which H. A. Burnham of Boston is chairman. This report was on the subject of the control of water waste, which may occur through private fire service connections. It was shown that arbitrary restrictions as to the size of private connections did not present a solution of the problem, which required individual consideration in accordance with local conditions in each case, being an engineering matter. Such waste, according to the committee, can in almost every case be prevented by common-sense methods.

Pier Protection—The report of the Committee on Piers and Wharves, finally adopted after being in formative stage for several years, was an important contribution to the work of the association. The fact that the average pier fire during the past few years has resulted in $250,000 damage shows the importance of this subject. Other organizations co-operating were the American Association of Port Authorities, American Concrete Institute, American Institute of Marine Underwriters, American Society of Civil Engineers, and Society of Terminal Engineers.

Oil Fire Risks—The item on the program provoking the most protracted discussion was the report of the Committee on Flammable Liquids, which by a divided vote had brought in recommendations for amendments to the table of minimum distances between oil storage tanks and adjoining property. The oil company members of the association contended, and were supported in their views by a considerable group from outside the oil industry, that distances considerably less than those which have been recommended by the association are adequate to provide reasonable safeguards for property which is exposed to damage by fire in adjacent oil tanks. The matter is an important one to the oil industry for the required distance between these above-ground storage tanks and adjacent property governs the amount of ground area which must be devoted to oil storage purposes. The oil industry maintains that with the modern all-steel tank construction the possibility of fire is remote and that the fire experience shows that the few fires which have occurred in all-steel tanks have usually been extinguished without a great deal of difficulty. On the other side was a group of conservatives led by certain insurance interests who maintain that the old distances are none too great and should not be decreased. They cited a record of oil tank fires which had been responsible for destroying adjacent property in many cases several hundred feet away and made the point that while the best type of tank construction might when new justify the claims made for it, there was no assurance that these steel tanks would remain gas-tight or that they would not be damaged under service conditions. It was impossible to decide the matter on the floor of the convention, so it was finally referred to a conference committee of five members, including representatives of the American Petroleum Institute, the Bureau of Explosives, the International Association of Fire Engineers, National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Companies, and the unanimous recommendations of this committee will be accepted by both parties to the controversy.

The protection of intangible values is receiving much more attention in the association than in its earlier years when the tendency was to limit discussion of fire losses to matters of dollars and cents. The Committee on Protection of Records presented a comprehensive

report, which while by no means final was felt to be valuable in that it summarized and crystallized the present engineering judgment on this subject which has been of so much current interest since the Burlington Building fire in Chicago.

Safety To Life—The Committee on Safety to Life presenting the National Building Exits Code continued along the lines as followed in its previous reports, but presented for the first time a new treatment of the relation between population and exits. A formula has been developed by this committee giving a direct ratio between the safe maximum population of buildings and the number of stairways or other exits. This depends on the character of building construction, the height, occupancy, sprinkler protection, etc. For example, a building with automatic sprinkler protection is considered to be so superior to a similar building without sprinkler protection that it may have twice the population for given exits as the same building without sprinkler protection. A similar formula has been developed for determining the maximum height of buildings consistent with life safety for their occupants.

Some fifteen other technical committee reports were received and discussed. These may be obtained from the National Fire Protection Association (Executive Office, 40 Central St., Boston).

Rudolph P. Miller of New York was elected president for the coming year. Dana Pierce of the Underwriters' Laboratories, Chicago, and Allan M. Schoen, chief engineer of the South-Eastern Underwriters' Association, Atlanta, were elected vice-presidents.

Locating Water-Borne Typhoid Infection at Brenham, Texas

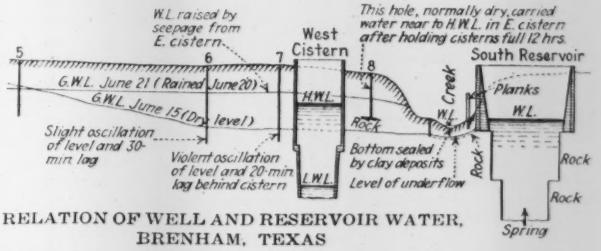
By George W. Colles

Consulting Engineer, Angleton, Tex.; formerly Sanitary Engineer, Texas State Board of Health

THE CONTINUANCE of occasional typhoid epidemics in Brenham, Texas, led to a second investigation of the water supply in 1923. The first one was made by the State Board of Health in 1919, and showed the water of a large spring, which formed the principal source of supply, to be contaminated with surface water seeping into the basin sunk around the spring for storage. This water was then cut off from the system and the remaining water, which is from wells and in which no contamination was found, was chlorinated. Continued bacterial tests of the chlorinated water failed to show any pollution, yet a process of exclusion pointed to the city water as the most likely source of the typhoid.

The writer was called in to locate any possible source of contamination. The water from the four wells, sunk in rock to a depth of 100 to 200 ft., was perhaps open to some question as to surface seepage, but the more obvious source was the two sunken cisterns into which the pumped well water flowed by gravity. One of these, 20 ft. deep, receives the well water and delivers it through a valved connection to the other, 28 ft. deep; from the latter water is drawn by the pump-suction pipe reaching to the bottom. The former has a concrete lining which appears fairly tight, but the latter has a brick lining in poor repair and full of large crevices. A small stream carrying foul water flows hard by the walls of the two cisterns, whose bottoms are 5 and 15 ft. lower, and pollution from this source is almost obvious.

Investigation showed that seepage from the creek could not take place, owing to the ground-water level at the cisterns being at all times higher than that of the creek; but that all the creek water was derived from the ground water and so represented its character. Samples from numerous test holes bored in the vicinity of the cisterns all showed the presence of colon bacteria. Several hydraulic tests showed that there was a regular in-and-out wash of water through the walls of the brick-lined cistern, and that inseepage at periods of low water, which takes place four or five times a day, was on a large scale. This seepage would, of course, be largest shortly after a rain, when the level of ground water would rise quickly 5 or 6 ft. It was supposed to



RELATION OF WELL AND RESERVOIR WATER, BRENHAM, TEXAS

be the heavy rain of May 2 that started the latest epidemic, but pollution was laid to a rise in the creek instead of the ground water.

Pollution was in this case positively proven where all direct bacterial tests failed to show it. The first examination by the Board of Health did not disclose it, nor did the routine tests of the superintendent, nor, it may be added, was it shown very conclusively by bacterial tests even after this proof was made. The writer is of the opinion that one reason for this is that samples are always taken from the surface of the water in the cistern, whereas the seepage takes place at or near, and the water is always drawn from, the bottom. Prior to this investigation the routine examinations were of the chlorinated water. With a highly varying quality of water (from good to bad four or five times a day) even what would be, for most of it, an overdose of chlorine might not suffice for the worst of it, and that worst would occur between tests.

Startling Water-Works Figures from Chicago

Pumping stations as numerous as school houses and a lake bottom honeycombed with tunnels is the eventual condition of Chicago if the present meterless condition continues, states John H. Ericson, city engineer of Chicago, in a 30-p. pamphlet on the water-works system issued for general distribution. Without meters filtration is financially impracticable and the city must depend on sewage diversion from Lake Michigan through the Calumet and Chicago Rivers, with water diversion for dilution, and on chlorination of the water supply. The 83 billion gallons of metered water in 1923 paid $5,515,638 against $3,622,978 collected for an unmetered 211 billion gallons. If meters were universal instead of being on less than 10 per cent of the 345,692 services, Mr. Ericson states that the average of 800 m.g.d. for 1923 would not again be equaled until 1953. Without more meters the consumption will be 2,000 m.g.d. 30 years hence. During the past year 151,021 tons of coal were used at the Chicago pumping stations and 366 tons of liquid chlorine were consumed for the chlorination.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Computing Backwater Curves

Sir—At intervals writers in *Engineering News-Record*, as on April 24, 1924, page 719, give complicated formula for backwater computation of regular channels which seldom occur in practice, or question the accuracy of Kutter's formula for the usual case of irregular river channels.

Prior to construction, in 1906, backwater computations were made by members of the resident engineer's staff for floods of 300,000 and 750,000 sec.-ft. on the proposed McCall Ferry dam across the Susquehanna River. Later the operating staff of the Pennsylvania Water & Power Co. observed the backwater effect of various floods, including 300,000 sec.-ft. flow. They did not know of the previous backwater computations at the time but these were brought to their attention in 1923 for checking the method used. The following tabulation shows surprising results:

Section Location	Distance Above Dam Miles	Backwater Elevation — M.S.L. in Feet by Computation in 1906	Backwater Elevation — Actual Gage Height Record
Section 5	4.8	176.69	176.7
Safe Harbor	7.8	179.86	179.8

The computed results were obtained by using Kutter's formula after the manner now given in King's Hydraulic Handbook. The coefficients used were obtained from the data of surveys of the sections and their stream flow rating curves. The results justify the time and care spent in getting good data as a fundamental requisite. Any attempt to short-cut this essential and judgment in application will be reflected in inferior results. BOYD EHLE,

Construction Engineer, Susquehanna Power Co.

Conowingo, Md., May 3, 1924.

Strength and Life of Bituminous Pavements

Sir—In *Engineering News-Record*, April 24, p. 738, A. J. Donargo takes issue with Troy Carmichael, city engineer of Helena, Mont., whose interesting article on paving design appeared in *Engineering News-Record*, March 6, p. 418.

Mr. Donargo asks two questions and as a question is usually asked for the purpose of obtaining a reply may I ask indulgence while I attempt to reply to Mr. Donargo's questions, which are: (1) Who would compare the strength of bituminous pavements with that of concrete? and (2) How long could the former type last with the modern heavy traffic pounding away at it before it would have to be renewed or replaced with the rigid type of pavement?

Strength in a pavement should properly be interpreted as the ability to withstand those forces which tend to destroy the pavement and not as the ability to support a static load. While it is admitted that the compressive strength of portland cement concrete increases with age it has been ascertained by investigation that the strength of portland cement concrete decreases with age in its ability to resist repeated loading. This lessening power of resistance is known as fatigue. The asphaltic type of pavement while not designed to support a heavy static load is admirably adapted to withstand the shock of impact and unlike the rigid portland cement concrete slab it does not suffer from fatigue. Thousands of examples demonstrate this.

Exceedingly heavy truck traffic makes use of New York city streets paved with asphalt on portland cement concrete bases and according to the official records of the Bureau of Manhattan the average age at which the asphalt surfaces are replaced is 18.2 years. Not even the most ardent advocate of portland cement concrete would contend that the concrete bases, as now laid, in the city of New York would withstand this traffic in the absence of the asphalt top. In the city of Buffalo the average age of the asphalt pavements at time of renewal is about 23 years and in the city of Washington it is about 27 years,—these statements being taken from official records. I have within the past two weeks inspected an asphalt base and top pavement on East Clinton St. just beyond the city limits of Trenton, N. J., laid two years ago and serving the heavy trucking of the De Laval Separator Co. and other large industrial plants. This type of pavement was selected on account of the fact that a concrete base would require the shutting off of traffic for two weeks while the asphalt base and top involved the shutting off of traffic for only four hours. Today after two years intensive service there is not a flaw in the pavement while the portland cement concrete immediately adjoining it is badly cracked and shattered. On the Pacific coast there are many million square yards of asphalt pavements on asphalt bases which have carried the heaviest trucking known in California for from 10 to 30 years and are today in excellent condition. In the city of Chicago there are large areas of city pavements laid on macadam which are taking exceedingly heavy truck traffic satisfactorily.

The replacing of asphalt with concrete does not seem to have been making rapid headway in the light of the fact that on Jan. 1, 1923 in 65 cities of 100,000 population or more in the United States the bituminous types comprised 56.7 per cent of the total yardage higher than waterbound macadam while portland cement concrete comprised 2.9 per cent. In the twelve American cities having the largest paving yardage the bituminous types comprised 59.5 per cent while portland cement concrete comprised 2.5 per cent. If Mr. Donargo will carefully observe the resurfacing in the large cities today he will find that they replace asphalt with asphalt and not with concrete. So far as the country as a whole is concerned, the bituminous types gained in 1923 over 1922 about 20 per cent in yardage while portland cement concrete paving lost 3 per cent as compared with 1922.

In his analysis of portland cement concrete design Mr. Donargo reaches the conclusion that the strengthening of the corners and sides of the slabs provides a sound design and he concludes that the use of a longitudinal joint will eliminate the necessity for reinforcing the inner portion of the slab. When a longitudinal joint is provided or when a longitudinal crack forms in the slab the result is that the original slab is transformed into two slabs and that the original four corners are thereby increased to eight corners and the two sides to four sides. This fact is recognized by engineers in some of the states who attempt to meet it by providing a tongue and groove joint down the center with the idea that the tongue and groove will act as a hinge. It is yet to be shown that the relatively thin tongue will stand against expansion and contraction and the shattering of impact. Some center joint advocates have even proposed that the tongue and groove joint be placed in portland cement concrete foundations for asphalt pavements. The asphalt industry does not favor such practice. It believes that any joint in the foundation will be a source of weakness. J. E. PENNYBACKER.

New York City, May 5, 1924. General Manager, The Asphalt Association.

Searchlight Towers

Sir—Referring to the article on "Disappearing Searchlight Towers" in *Engineering News-Record* of Feb. 7, 1924, p. 227, it is interesting to note that similar towers operating on similar principles were designed and constructed by the United States Lighthouse Service several years ago.

The towers are built of light steel shapes and mounted on reinforced-concrete piers which support journal bearings for the trunnions. A concrete counterweight on each tower is properly proportioned and placed to steady the tower in any position. One man can lower or raise one of these towers without effort, and the tower can be locked in either its upright or prone position. A steel ladder provides access to the top when tower is erect.

These towers carry range lights, a special equipment of the lighthouse service, fitted for electric lamps using 230-volt current, carried by submarine cables and transmission lines from an independent electric power plant. Flexible electric connections preclude current interruption at the trunnions. An automatic time switch turns on the light at sunset and puts it out at sunrise. H. B. BOWERMAN,

Chief Construction Engineer, Bureau of Lighthouses.

Washington, D. C., April 21, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Extensive Public Works at Pittsburgh Under Way

Improvements Totaling Near $30,000,000 Cover Road, Bridge and Tunnel Projects

Public improvements totaling nearly $30,000,000 in cost were authorized by vote of the people of Allegheny County, Pennsylvania, on April 22, authorizing specific bond issues for road, bridge and tunnel projects and for a county office building. The large items of the program are $18,447,000 for bridges and $8,000,000 for road improvements. The other items are $1,660,000 for a street tunnel on the line of Second Ave., and $1,100,000 for a county office building.

Eight of the bridges that are to be built exceed $1,000,000 in cost. The largest will be the Liberty bridge, providing direct connection from the city to the just completed Liberty tunnels through the South Hills, at a cost of about $3,700,000. Reconstruction of the Point bridge will cost $2,300,000; this project is unusual in that the Point bridge is at present under city jurisdiction, but the replacement structure is to be built by the county. Rebuilding the three Allegheny River bridges at Sixth, Seventh, and Ninth Sts. will cost from $1,200,000 to $1,500,000 each. The other large structures are to be located at 31st St., at McKeesport, and at Clairton. Eight other bridges involve costs exceeding $100,000 each.

Priority Given

Priority in carrying out this large construction program will be given to the Allegheny River bridges at Sixth, Seventh, and Ninth Sts. It is expected that contracts for the substructures for these bridges will be advertised and awarded within three or four months, in order that the demands of the U. S. War Department for the removal of the old structures may be complied with as rapidly as possible. The Seventh St. bridge has already been demolished, and the construction of a new bridge is to be undertaken first. In the case of the Sixth and Ninth St. bridges it is planned to construct the new foundations before removing the old bridges.

Extensive replanning of the downtown street system and traffic routes is involved in the construction of the new Liberty bridge, which will bring its traffic to the downtown section at a point a short distance east of the business district, whence it will have to be distributed to the principal avenues of the business district. The street replanning is also affected by the Second Ave. tunnel and other public improvements that are under active discussion at present, including the flood protection improvement along the river front, a railroad freight house at Forbes St., and the proposed rapid-transit development. These matters are being studied jointly by the new Department of Public Works for the County of Allegheny, the County Planning Commission, the Department of Public Works of the city, the City Planning Commission, and the Citizens Committee on City Planning.

The Second Avenue tunnel project contemplates a pair of vehicle tunnels similar to the recently built Liberty tunnels, of total length about 1,040 ft., extending from Second Ave. near the end of the South Tenth St. bridge, northward to Forbes St. near Hooper St. Its object is to provide for more direct street connection eastward, avoiding the crossing of a high hill, and also to reduce the concentration of traffic from the South Side now entering the business district by way of Second Ave. and the Smithfield St. bridge.

All these projects are being planned and will be executed under the direction of Norman F. Brown, director of the department of public works of the county, and Charles M. Reppert, assistant director. The department is now engaged in preparing a major road plan of the county, in preparation for the selection of road-improvement projects.

Providence Water Filter Contract Awarded At $1,799,210

The contract for the new water filtration plant for the City of Providence, R. I., was awarded on May 21, the day bids were opened, to Winston & Co., Inc., Kingston, N. Y., for $1,799,210. This firm is building the Scituate dam. The other four bidders are given on p. 313 of our Construction News Section this week and the unit prices will appear in that section on June 5. The contract includes a 50-m.g.d. mechanical filter plant, a 160-m.g.d. open coagulation basin, etc., besides portions of the main aqueduct. (See *Engineering News-Record*, May 8, 1924, p. 824.) Frank E. Winsor is chief engineer of the Providence Water Supply Board.

Permits for 237,000 Hp. Issued in California

The Department of Public Works of the State of California has issued four permits for the diversion of water for power purposes in that state, aggregating 237,000 hp. and estimated to cost $18,840,000. They have been issued to the Turlock Irrigation District, Turlock, Calif., for the development of 22,543 hp. on the Tuolumne River; to the Modesto Irrigation District, Modesto, Calif., for the development of 19,210 hp. on the same river; to H. L. Jackman, Eureka, Calif., for the diversion of 9,000 sec.-ft. from the Klamath River for the development of 92,045 hp.; and to the Electro Metals Co., San Francisco, Calif., for the diversion of 3,075 sec.-ft. from the Klamath River for the development of 103,295 hp.

New York Conference Hears Traffic Report

Over 400 Representatives Attend All-Day Session—Dinner-Discussion Ends Meeting

Traffic congestion was the subject of a conference held at the Town Hall, New York City, May 20 under the auspices of the committee on Regional Plan of New York and Its Environs. Delegates from over 400 municipalities and organizations of business and professional men were present. The meeting was addressed by Mayor John F. Hylan, of New York, Governor George S. Silzer, of New Jersey, and a number of others. The important technical activity was the presentation, with numerous lantern slides, of a report on the traffic problem of New York by E. P. Goodrich and H. M. Lewis, engineers for the regional plan committee.

Following the day's conference a dinner was given by the committee to mayors and village representatives in the New York region, and after that the session was devoted to a general review of the New York Regional Plan.

The meeting was opened by Frederick A. Delano, chairman of the committee.

Dwight W. Morrow, a member of the committee and a New York banker resident in New Jersey, outlined some of the surveys of industry made and being made for the committee. It would be a large contract, Mr. Morrow stated, to declare by statute where various industries shall go, but it is quite proper and possible to point out the advantages offered by different sections of the regions being studied. When it is known what people are doing, where they are doing it, where and how they live, how they get from home to work and back again, those concerned in planning for the future will know better how to go about it.

In a general discussion that followed the three formal addresses, Frederick B. Pratt, secretary of Pratt Institute, Brooklyn, dealt particularly with Long Island conditions.

Thomas Adams, director of the staff of experts of the Regional Plan Committee, stated that some 200 engineering studies are being made. Six groups of engineers are at work on the uses of land and four groups of architects on the architectural problem. Legal and public relation studies are being made.

Upham Heads Highway Board

C. M. Upham, state highway engineer, North Carolina Highway Commission, has been appointed director of the Advisory Board on Highway Research of the National Research Council. Mr. Upham takes up the direction of this work at Washington following Dr. W. K. Hatt who occupied the position for two years during a leave from Purdue University.

Give Dinner and $7,000 Purse to Diven

A.W.W.A. Recognizes Secretary's Long Service—Louisville Next Meeting Place—Progress Reported

A good start to the forty-fourth annual convention of the American Water Works Association held in New York City, May 19-22, was made by the testimonial dinner on the evening of the first day to J. M. Diven in recognition of his many years of service to the association and of his retirement from the active secretaryship. A purse of $7,000 was presented to Mr. Diven at the dinner. Later on he was made secretary emeritus of the association. At least three other publicly announced dinners were held, including one by the Chemical and Bacteriological Section, one by the Service des Eaux and one of "old-timers" or members who joined the association and attended its conventions prior to 1900. Entertainment provided by the Water Works Manufacturer's Association included a boat excursion to Bear Mountain and dinner there, a smoker, and a theater party at the Hippodrome for the ladies.

The retiring president and chairman of the Standardization Council, George W. Fuller, New York City, presented a Development Program (see *Journal* A.W.W.A., May, 1924) the main points of which were noted editorially in our issue of May 15, p. 835, and appeared below as adopted or endorsed by the convention.

On recommendation of the Executive Committee, a budget totaling $30,000 was approved for the next year. It was announced during the meeting that the membership had passed the 2,000 mark.

Constitution Revised

Constitutional amendments adopted by the convention created the position of secretary emeritus; increased the number of geographical sections from six to nine, making Canada a district by itself; made a more liberal allotment of funds to geographical sections; and provided for the formation of various divisions on request of thirty or more members, subject to the approval of the Executive Committee; and authorized an allotment of $100 a year for division expenses. The secretary emeritus must be a person who has served the association for fifteen years as secretary. He will be a member of the Executive Committee.

Officers for the ensuing year include: President, Frank C. Jordan, Indianapolis; vice-president, Harry F. Huy, Buffalo, N. Y.; treasurer, W. W. Brush (re-elected). New trustees by districts, the last three for the newly created districts, are: No. 6, J. C. Jensen, Minneapolis; No. 4, E. M. Hoopes, Jr., Wilmington, Del.; No. 1, Alexander Milne, St. Catharines, Ont.; No. 5, J. E. Gibson, Charleston, S. C.; No. 9, F. M. Randlett, Portland, Ore. The new Executive Committee announced the appointment of W. M. Niesley as secretary and also the creation of an Administrative Committee to act between sittings of the Executive Committee, the new committee consisting of President Jordan, George W. Fuller, Charles R. Bettes, W. W. Brush, W. S. Cramer and J. M. Diven. Mr. Niesley, the new secretary, has been in the secretary's office since July, 1923, and in direct charge under Messrs. Fuller and Diven since the latter resigned as secretary a few months ago and returned to Troy as superintendent of water-works there.

Two new divisions created during the convention were (1) Fire Protection and (2) Plant Operation and Maintenance. The officers of the first are: Nicholas S. Hill, New York City, chairman; Clarence Goldsmith, Chicago, secretary-treausrer. The officers of the second are: W. S. Cramer, Lexington, Ky., chairman; John M. Diven, secretary. The new chairman of the Chemical and Bacteriological section is Prof. A. M. Buswell, Urbana, Ill.

Honorary members elected were H. E. Keeler, Chicago, for a long time the treasurer of the association; J. M. Diven and Clemens Herschel.

On the Standardization Council, after having served four years, Col. George A. Johnson and Prof. Edward Bartow were replaced by E. E. Wall, St. Louis, and W. S. Cramer, Lexington, Ky. A new committee, on Boiler Waters, was created with S. T. Powell, Baltimore, Md., as chairman. Reports and papers by the various subcommittees of the council were a leading feature of the convention.

Louisville got the next convention. On the first ballot Louisville had 98 votes; Atlanta, 82; Baltimore, 37; Milwaukee, 19. On the final ballot, with the two lower places eliminated, the vote stood 116 to 94.

As a stimulant to the work of the various subcommittees just mentioned and as a means of making the results of committee work readily available to the members, the convention approved arrangements made by the Executive Committee for a "Manual of American Water-Works Practice." The book will be published and sold by the Williams & Wilkins Co., of Baltimore, and a royalty on the sales will be paid to the association by the publisher. Hereafter the American Water Works Association and the American Public Health Association will revise from time to time and publish jointly the Standard Methods of Water Analysis heretofore put out by the A.P.H.A.

For the committee on standard form of contracts, John M. Goodell, secretary, reported that some further revisions had been made in the tentative forms on trial during the past year and that a revised edition would soon be ready.

The program of the convention on Tuesday evening was in the hands of the Water Works Manufacturers Association and included the following: Development and Manufacture of Engineering and Surveying Instruments, W. L. Egy, assistant chief engineer, W. & L. E. Gurley, Troy, N. Y.; Progress in the Chemistry of Precipitation and Coagulation, H. M. Spencer, of the Seydel Chemical Co., New York City; the Development and Manufacture of Modern Cement-Lined Service Pipe, Reeves J. Newson, water commissioner, Lynn, Mass.; Observations on the Chlorination of Small Water Supplies, M. J. Tiernan, of Wallace & Tiernan, Newark, N. J.

The Chemical and Bacteriological Division held three sessions, with a program of technical and special papers, three important committee reports, and topical discussions.

Truck Runway Collapse Kills 4

Four men were killed and others injured in New York City on May 24 when, through causes now under investigation, the truck platform built out over a deep excavation on West 46th St. between Sixth Ave. and Broadway collapsed. Those killed were workmen excavating pier holes directly beneath the platform. The principal part of the basement excavation had been completed. The platform, which at the time of the accident held a concrete mixer, was built of apparently strong enough materials; the posts were 12 x 12-in. timbers and the stringers 12 x 14-in. timbers overlaid by 2 x 8-in. planking. Just what caused the collapse cannot well be determined, but it is believed that vibration from blasting was a contributing factor. A heavy shot had been fired about an hour before the accident.

Testimony Favors Ransdell Bill for Hydraulic Laboratory

Testimony in support of Senator Ransdell's bill proposing the establishment in Washington of a national hydraulic laboratory was given before the Commerce Committee of the Senate May 21 by Dr. Elwood Mead, the Commissioner of Reclamation; N. C. Grover, chief hydraulic engineer of the U. S. Geological Survey; and by L. W Wallace, executive secretary of American Engineering Council. Dr. Mead declared such a laboratory could be used in connection with the large number of water problems which confront the Reclamation Service. Mr. Wallace told the committee that he had discussed the matter with engineering societies in many states without having heard a single voice against the proposition.

John R. Freeman, one of the principal advocates of the hydraulic laboratory, telegraphed from San Diego that work there in connection with the extension of the municipal water-works, and an engagement at Chicago in connection with the diversion from Lake Michigan, would preclude his appearance before the committee prior to adjournment of this session of Congress. He stated in his telegram, however, that he is convinced that the bill is a measure of economy in the expenditure of millions of dollars by federal, state and city governments.

Commerce Secretary Hoover could not appear at the hearing as he had to testify at the same hour before the Committee on Interstate Commerce. He wrote a letter, however, supporting the proposition.

Army Engineer Holds Golden Gate Bridge Hearing

Possible Obstruction to Navigation and Financial Plan Form Chief Discussions

A formal hearing on the proposed Golden Gate bridge at the entrance to San Francisco bay was held by Col. Herbert Deakyne, Corps of Engineers, U. S. A., in San Francisco on May 16. The purpose of the hearing Colonel Deakyne announced was to receive information that would aid the War Department in deciding whether to grant permission for building the bridge. The question emphasized was whether it might obstruct navigation to a degree that would warrant denying the application. Speakers were also questioned as to plans for financing the structure.

The bridge under consideration, designed by J. B. Strauss, would have a combined cantilever and suspension span 4,000 ft. long supported on piers near each shore in 50 ft. of water, the over-all length of the main and approach spans being 6,700 ft. The towers would be 1,005 ft. high and the two main cables 30 in. in diameter; stresses are based on a live loading of 3,000 lb. per lineal foot. The over-all width of the bridge would be 80 ft. with a roadway width of 52 ft. The structural steel required would total 80,000 tons in addition to 6,000 tons of cable. Previous reference to the Golden Gate bridge scheme appeared in *Engineering News-Record*, Jan. 25, 1923, p. 181, and July 19, 1923, p. 86.

M. M. O'Shaughnessy, city engineer of San Francisco, affirmed the feasibility from the engineering standpoint of building such a bridge and suggested a tunnel approach on the north that would join the state highway about three miles beyond Sausalito. His estimate of cost for bridge and approaches was $25,000,000.

J. B. Strauss stated that he found neither the cantilever nor the suspension type practicable for this crossing and had therefore combined these two types in a structure that he estimated would cost $21,000,000. In response to Colonel Deakyne's questions Mr. Strauss said that bombs would not cause the bridge to collapse unless both cables were broken, in which case wreckage would fall into water 300 ft. deep. Should one end of the bridge be destroyed by explosives any obstruction to navigation could be removed by dropping the other end in a like manner, which could be done very quickly.

Other Speakers

Other speakers representing civic bodies, cities and counties from the Oregon line to Sacramento voiced enthusiastic support of the scheme and promised financial aid. Some of the points brought out were that benefits of the bridge would include: (1) cutting in half the time of the present ferry communication trip; (2) provide a means of delivering perishable produce without transshipment; and (3) improve access to vacation resorts by eliminating delays at auto ferries. As an indication of the rate at which the bridge would develop auto traffic it was cited that last year the new auto ferry across the Golden Gate ferried 400,000 cars and 1,000,000 people without cutting into the business of existing ferry routes.

The bridge district, comprising a large part of northern California, organized by proponents of the plan, has authority to construct the bridge under the Enabling Act recently passed by the State legislature and hence if War Department permission is given it only remains to finance the work.

No protests were presented nor was any critical comment offered on the proposed design. Public announcement of the War Department's decision, Colonel Deakyne said, would be made as soon as possible.

London Subways To Be Extended

Contracts for driving the necessary tunnel to extend the city and South London Ry. from Clapham Common to Morden have been let, according to *The Engineer*, London. The contract is let in two sections, one to the Foundation Co., Ltd., a branch of the American firm of the same name. The cost of the tunneling alone is estimated at $3,000,000 and the completed tunnel with equipment at $16,000,000. Fifteen months are allowed in which to complete the tunneling, and if the work is finished in this time it will create a new record for tube tunneling in London. It is understood that ten rotary excavators, each capable of making an advance of from 15 to 20 ft. per day are to be employed. The total length of tunnel is 4½ miles.

Contract for another section to be a link between the Hampstead and Highgate Ry. at Charing Cross and the City and South London Ry. at Kensington has been let to a British concern. This section will be carried for part of its length under the bed of the River Thames and the contract calls for its completion within 2½ years.

B. & O. R.R. to Electrify 40 Miles of Track on Staten Island

According to a recent announcement of the Baltimore & Ohio Railroad Co. concerning the electrification of its Staten Island Rapid Transit Railway line, the electrification as approved by the Public Service Commission will include the passenger service on the East Shore and Perth Amboy divisions. This includes the lines between St. George, South Beach and Tottenville, a total of about 40 miles of track.

The section between Prince's Bay and Pleasant Plain, which is now single track, will be double track and grade crossings will be eliminated on this section. Electrification will necessitate the installation of practically an entire new signal system. The direct-current signals now installed will be superseded by a modern alternating-current signal system.

Nominal 600-volt direct-current third-rail system will be employed. Preliminary plans cover the over-running protective-type of third-rail construction with 150-lb. third rail of special high conductivity steel.

The cars for this service will be of all-steel construction, approximately 67 ft. in length and seating 71 passengers.

Commission Advises Philadelphia Spend $99,000,000 on Water

Early abandonment of the Schuylkill River as one of the sources of water supply of Philadelphia, the introduction of meters, the improvement and enlargement of the Torresdale filtration plant on the Delaware River to make the abandonment possible, the development of an additional supply from the Perkiomen and Tohickon creeks by the construction of dams, reservoirs and conduits and a new service reservoir in the city, all at a cost of $99,000,000 for the full scheme, are the chief recommendations of a report made on May 22 by the Water Commission appointed by Mayor Kendrick of Philadelphia in February, 1924. The commission comprises George R. Biles, director of public works, chairman; Alexander Murdoch, chief of the bureau of water; Solomon M. Swaab, consulting engineer to the city; and consulting engineers George W. Fuller, Joseph F. Hasskarl, J. Waldo Smith, and Allen Hazen, Mr. Hasskarl being of Philadelphia and the other three of New York City.

At present prices the estimated cost of the Perkiomen-Tohickon project, complete, is $91,500,000. It does not lend itself to deferred construction but work to the amount of about $16,500,000 could be deferred. The very first step advised is metering, which would lessen the demand on the filters that treat Schuylkill water and improve the output. Next the Torresdale filters should be brought to the full proposed capacity. To build the new Perkiomen-Tohickon supply would require six to eight years.

Latin-Americans to Inspect Roads

Governors of North Carolina, Illinois, Minnesota, Wisconsin, and Michigan, representing the five states where the principal highway studies are to be made, will greet during June the 38 delegates from Latin-American countries here to make a field study of highways and highway transportation. After entertainment in Washington, D. C. on June 2 and 3, the delegates will leave for Raleigh, N. C., the first stop. There the offices of the state highway commission will be inspected with Frank Page, the commissioner, and Charles M. Upham, state highway engineer, as guides. The North Carolina cities included in the itinerary call for temporary headquarters to be established at Durham, Greensboro, Winston-Salem, High Point, Asheville, Chimney Rock, and others.

From North Carolina, the party will go to Springfield, Ill., where special attention will be given to the maintenance and oiling of black soil earth roads. Before reaching Illinois, however, the party will stop at Lexington, Ky., and at Cincinnati, Ohio. In Illinois an inspection of the Bates test road will be made June 12.

Three days will be spent in Minnesota, the party arriving in St. Paul, June 15. On June 18 the party will arrive in Madison, Wis., whence they will motor to Milwaukee, spend an evening there, and entrain for Michigan by way of Chicago on June 20.

Liberty Tunnel Tie-Up Charged to Panic

Poor Traffic Control also Contributing Factor, Report of County Officials Indicates

Full accounts of the tie-up in the Liberty tunnels, Pittsburgh, on May 10, which was reported to have resulted in a large number of serious cases of gas poisoning (see report in May 15 issue, p. 874), indicate that panic combined with ineffective traffic control was the outstanding factor of the incident and that the gas poisoning effects were slight, although the carbon-monoxide percentage rose dangerously high.

Due to a strike of street-car employees which began Friday night, May 9, a heavy traffic congestion developed in the downtown section of Pittsburgh on Saturday, May 10, and automobile congestion extended for considerable distances along a number of the inbound thoroughfares and notably along the Liberty tunnel route from the populous South Hills. Along this route the congestion extended from the downtown section of the city across the Monongahela River (Smithfield St. bridge) and up Carson St. and Brownsville Ave. to and through the inbound tube of the tunnel. Traffic through the tunnel Saturday morning far exceeded all previous figures, and in the single half hour from 7.30 to 8 Saturday morning 649 cars entered the inbound tube, as reported by the checker who kept the traffic count in the tunnel. Due to the traffic jam in the streets approaching the city, vehicles were compelled to halt frequently in their progress through the tunnel. This reduced the ventilating effect of the moving line of automobiles, and at the same time the volume of exhaust gases was increased, if anything, as the drivers of many of the machines ignored the orders of the traffic officers to shut off their engines while stopping. The condition of the air became noticeably bad, and some of the passengers began to be affected by the vitiation of the tunnel atmosphere. As the effect progressed a panic began, and many persons abandoned their machines and rushed towards the ends of the tunnel.

No Serious Cases

Twelve persons were taken to hospitals, but it developed that none of the cases was serious and by noon most of the patients had been discharged. There were no fatalities. The most seriously affected were county or city employees engaged in clearing the tunnel.

A sample of tunnel air, taken about the time the people in the tunnel began abandoning their machines, showed 0.25 per cent carbon monoxide. This sample was taken among the machines and is considered to represent the air at a point of maximum concentration and not the average condition in the tunnel at the time. According to the Bureau of Mines experts the concentration given would produce unconsciousness in 30 to 45 min. if breathed continuously.

Because of the tie-up and the necessity of hauling out the abandoned machines and restoring regulated traffic, the inbound tunnel was out of service about 6 hours. Thereafter traffic was operated through the tunnels as before.

Charles M. Reppert, assistant director of the Department of Public Works, County of Allegheny, states that the tunnels were put into operation some months ago because of the very urgent need for the improved traffic facilities which they supply, although the mechanical ventilating system which was being installed was not yet completed. The decision to permit traffic through the tunnel was taken after careful studies by the mine-gas experts of the U. S. Bureau of Mines, which led to their approving the proposal. Arrangements were made with the Bureau of Mines to keep constant check on the air conditions in the tunnel by gas analyses. Traffic was to be restricted in accordance with the necessities of proper atmospheric purity. Since the tunnels were opened, the worst air conditions, which occur during the morning and evening traffic peaks, have not been bad enough to cause any alarm. The traffic congestion resulting from the strike, however, produced abnormal conditions, largely due to failure of the traffic control to function efficiently.

No change in the use of the tunnel before completion of the ventilating system resulted from the accident. The county authorities concluded that the incident, however regrettable, gave no new technical information and added nothing to existing knowledge on the danger of exhaust gases.

N. Y. Firm Gets $35,000,000 South American Contract

George E. Nolan and Co., Inc., exporters and engineers of New York City, has closed a contract with the municipality of Buenos Aires, Argentina, which involves the opening of a diagonal thoroughfare a mile long and the construction thereon of modern steel buildings ten stories and less in height. The contract price is in the neighborhood of $35,000,000. Buildings to be erected will house municipal bureaus and semi-public enterprises, including a theater. Eventually there will be from sixty to seventy-five of these buildings, forming a unique civic center. The contractor is allowed five years in which to complete the first section of the work and six months in which to start construction. The company maintains a South American office; its New York address is 50 East 42nd St.

New Orleans Plans Building Code Revision

Upon recommendation of John Klorer, city engineer, the Commission Council of New Orleans has appointed F. A. Muth as engineer to correlate the information for the revision of the city building code by the code revision committee of the Contractors and Dealers Exchange of New Orleans.

American Money for Railways in Colombia, S. A.

Part of the $25,000,000 granted to the government of Colombia, South America, by the United States, under the treaty of 1922, is to be devoted to development of the railway system by extensions and new lines. The routes and lines included are as follows: Tumaco, Ipiales & Pasto Ry.; extension of the Southern Ry. to Fusagasua; Cartago north to Zarzal and south to Manizales; Arminia (on the Cartago-Zarzal line) east to Ibague; Cali south to Zarzal and north to Popayan; Puerto Wilches to Puerto Santo; the Antioquia Ry. and the Central Bolivar Ry. Construction has been commenced on the Northeastern Ry. from Bogota to the head of navigation on the Meta River, a tributary of the Orinoco River flowing into the Atlantic.

Health Conferences Held in Connecticut

There have been recently held at Hartford, Conn., two conferences, one on sewage disposal, and one of waterworks officials, under the auspices of the Connecticut State Department of Health. At the former conference the opening address was given by J. F. Jackson, director of the bureau of sanitary engineering of the State Department of Health. Storm water overflows, submerged outfall sewers, pumping of sewage, general discussion of sewage disposal, fine screening, septic tanks, Imhoff tanks, sand filters and disinfection of sewage were chief topics of discussion. At the meeting of the waterworks officials, which was also opened by Mr. Jackson, filtration, supervision and small supplies, purification, provision of auxiliary supply, sanitation on watersheds, chlorination and topics relating to the tie-up between health and water supply matters were among the chief discussions.

Port Authority to Build Two Bridges

Under laws enacted by the States of New Jersey and New York within the past month, the Port of New York Authority has been authorized to build and operate two bridges to connect Staten Island and New Jersey. One is to be located in the neighborhood of the present ferry crossing between Tottenville and Perth Amboy, the other near the northern end of Staten Island, connecting Holland Hook and Elizabeth.

With the grant of this power, the functions of the Port of New York Authority have been modified from those originally fixed, which were concerned with matters of transportation serving the Port of New York. The financial basis of the body has not been changed, however. The works to be built by the Port Authority must be financed by the sale of bonds based on the earning capacity of the works. It is generally believed that both the bridges authorized will attract very heavy traffic and will be able to pay the charges on their construction cost without difficulty.

WASHINGTON NOTES

Despite the Fact That the rent commission of the District of Columbia has been enjoined on the ground that the housing emergency has passed, the President and the Director of the Budget have recommended increased appropriations for the commission's expenses; and the life of the commission has been extended for one year.

The Senate Has Passed a bill authorizing the Secretary of the Interior to deposit in banks on or near reclamation projects funds available for the operation and maintenance of these projects.

Two Additional Members of the public Utilities Commission of the District of Columbia, one a Corps of Engineers officer and the second an attorney, are authorized in a bill that has been passed by the Senate. The three members of the Board of Commissioners of the District of Columbia also constitute the Public Utilities Commission.

Prospects Seem To Favor the passage before adjournment of legislation authorizing the construction of $50,000,000 worth of new public buildings in the District of Columbia. The government now is paying $800,000 annually in rentals. This amount must be increased immediately to house the 4,135 additional employes who are being engaged to handle the soldiers' bonus.

The President Is Expected to sign the bill that is now before him authorizing preliminary examinations on eighteen rivers to determine the engineering steps necessary to permit of adequate flood control.

The President Has Signed the bill providing for a commission of three to join with a Mexican commission in a study of the equitable uses of the waters of the Rio Grande. One of the American commissioners must be an engineer.

Expenditure of $25,000,000 on the Dieselization of Shipping Board vessels has been assured by the passage of legislation to that effect by the Senate. The bill previously had been approved by the House.

A Declaration of Intention covering the construction of a dam 50 ft. high in Totsaliga Creek, near Andalusia, Ala., has been filed with the Federal Power Commission by the River Falls Power Co., of River Falls, Ala. The probabilities are that the Federal Power Commission will not take jurisdiction. It is planned to install 4,800 hp. The Northwestern Power & Manufacturing Co., of Port Angeles, Wash., has applied for a preliminary permit to construct a diversion dam in the Elwha River. The company plans to carry the water through a 3½-mile canal to a powerhouse, a short distance above the head of the pool for an existing plant. It is estimated that 20,000 hp. can be developed in addition to the 10,000 hp. in the existing plant.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ROADBUILDERS ASSOCIATION, New York City; and North Carolina State Highway Commission, Raleigh, N. C.; Road Building and Maintenance Demonstration, Greensboro, N. C., June 3-7, 1924.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Meeting, San Francisco, Calif., June 11-13, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Convention, June 18-20, Pasadena, Calif.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 23-28, 1924.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Boulder, Colo., June 25-28.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 23-26, 1924.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

The New York Section of the American Society of Civil Engineers at its meeting May 21 elected the following new officers: President, John P. H. Perry; vice-president, Lieut.-Col. John R. Slattery; secretary, Harold M. Lewis; directors, Walter Spear and J. B. French; Allen Hazen, vice-president, and H. P. Hammond, treasurer, have another year to serve of their present term.

The Brooklyn Engineers' Club held its annual meeting May 8 and elected the following officers: Linford S. Stiles, president; Calvin C. Hough, vice-president; Joseph Strachan, secretary; and William H. Wharton, treasurer.

Personal Notes

C. F. Gettings, county engineer of Worcestershire, England, who has been studying road methods in the United States for a month, sailed for home May 24. While here he had studied road methods around Boston, New York, Harrisburg, Montreal and Toronto and had examined the experimental work of the Bureau of Public Roads at Washington. Mr. Gettings' jurisdiction at home covers 500 miles of highway. There are 26 local road authorities under his direction. He is secretary of the Midlands Branch of the County Surveyors' Society and is also a member of the Executive Committee of the central organization. The Midlands branch takes in 14 Midland counties.

Max E. Cook, for the past two years farmstead engineer at the Delhi State Land Colony, has been promoted to the managership of the state land settlement project with headquarters at Delhi. Mr. Cook succeeds Walter Packard.

H. H. Houk, formerly chief structural engineer, Bureau of Public Works, Manila, P. I., and recently highway bridge engineer, Bureau of Public Roads, located at Montgomery, Ala., has been appointed bridge engineer of the Alabama State Highway Department, succeeding L. G. Smith, who has been made chief locating engineer of the department.

Arthur L. Reeder, who for the past several years has been making studies and preparing a comprehensive report on the extension and improvements of the Reading, Pa., water supply, is now with Gannett, Seelye & Fleming, Engineers, Inc., of Harrisburg, Pa.

L. B. Holt, heretofore office engineer, New York Central lines west of Buffalo, has been appointed engineer of track for the same portion of the New York Central system.

Henry H. Couzens, general manager of the Toronto Transportation Commission, resigned recently as he had been appointed vice-president of the subsidiary companies of the Brazilian Traction, Light & Power Co., and will have headquarters in Rio de Janeiro, succeeding in this position F. A. Huntress. Mr. Couzens' successor as general manager of the Toronto Transportation Commission is **David W. Harvey**, who is promoted from assistant manager. The new assistant manager is **A. T. Spencer**, previously engineer of way.

C. S. Millard, until recently assistant general manager, Cleveland, Cincinnati, Chicago & St. Louis Railway Co., New York Central Lines, has been appointed general manager of that portion of the New York Central Lines. Mr. Millard began his service with the C., C., C. & St. L. in 1903 as engineer, maintenance-of-way.

John F. Richardson, for the past eight years manager of the Newlands Project in Nevada State, has resigned to become connected with a large American corporation operating mining properties in Brazil, Peru and Chile. His resignation is effective June 15. Mr. Richardson is one of the best known engineers in the employ of the Reclamation Service.

Alfred D. Flinn, director of Engineering Foundation, has been made an honorary foreign member of the Masarykova Akademie Práce, of Prague, as a token of appreciation for helpfulness extended by the Foundation and an expression of good will toward American engineers.

Felix H. Spitzer, consulting structural engineer for the Bureau of Building Inspection of the San Francisco Department of Public Works, announces his entry into an association with the firm of J. G. Little & Co., civil engineers, with offices at 251 Kearny St., San Francisco. Mr. Spitzer will continue his services with the San Francisco Building Bureau.

Maurice Parsons, formerly with Arthur D. Little, Inc., Cambridge, Mass., and for four years prior to that

with Lockwood, Greene & Co., in their Atlanta, Ga., office, has recently become a member of the structural division of Stone & Webster, Inc., Boston. Mr. Parsons, who is a Stanford University graduate, has had varied experience in estimating, designing and construction on many large engineering projects.

DOW R. GWINN, for 23 years with the Terre Haute (Ind.) Water Works Co., expects soon to leave his position of president and general manager. Previous to going to Terre Haute he was 19 years in the employ of the Quincy (Ill.) Water Works. Mr. Gwinn's plans for the future have not been anounced.

GEORGE A. CHRISTENSEN, until recently in charge of contracts and specifications for the Los Angeles Harbor Department, has been appointed chief building inspector of Long Beach, Calif., operating under the direction of R. D. Van Alstine, city engineer and director of the Public Service Department. Mr. Christensen succeeds Vern D. Hedden, who resigned to take up the practice of architecture.

CLAUDE L. MCKESSON, formerly senior highway engineer for the U. S. Bureau of Public Roads in charge of post road work in District 1 at Portland, Ore., was recently made materials research engineer for the California State Highway Commission.

O. N. FLOYD, whose former service was as assistant chief engineer of the Wichita Falls irrigation project in Texas, is now assistant chief engineer in the construction, for the water supply of the city of Dallas, Texas, of a large earth dam, concrete spillway and outlet conduits.

B. H. PALMER has been appointed county road engineer of Marion County, West Virginia, with headquarters at Fairmount, to fill the vacancy caused by the resignation of Frank J. Wilfong.

CHARLES HARDING is now connected with Case & Cothran, engineers and contractors, Asheboro, N. C., and is constructing a filtration plant for the town of Asheboro.

CONSOER, OLDER & QUINLAN, engineers, Chicago, Ill., announce admission to the firm as junior partners of Leslie Johnstone, Fred Oswald and George O. Consoer, all of whom have been employed by the firm as assistant engineers.

J. E. CRAWFORD, heretofore assistant general manager, Norfolk & Western Railway Co., has been promoted to general manager with headquarters at Roanoke, Va. Mr. Crawford is a graduate of the University of Pennsylvania and entered the service of the Norfolk & Western as bridge engineer in 1903, later becoming chief engineer and then assistant general manager in 1923.

RUDOLPH P. MILLER, consulting engineer of New York City, has been elected president of the National Fire Protection Association for the year 1924-5.

R. H. BARNWELL has been appointed as city engineer of Oceanside, Calif., succeeding F. Schwabland.

W. C. STURDEVANT has been appointed city engineer of Chehalis, Wash., succeeding Burwell Bantz, city engineer for the past six years, who has resigned to enter the abstract and guaranty business in Chehalis.

GEORGE R. NEWELL, civil engineer and surveyor, Rochester, N. Y., is president of the newly-organized engineering firm, George R. Newell, Inc., the other members, all engineers, being Harold F. Smeed, vice-president, Kenneth J. Knapp, secretary, and Gloster P. Hevenor, treasurer.

MALVORN J. MCCOMBS, recently chief of surveys for the engineering department of Dallas, Texas, has been appointed sanitary sewer engineer vice R. C. Ledbetter, resigned. Mr. McCombs is an engineering graduate of Texas Agricultural and Mechanical College and for fourteen years has been connected with the city of Dallas, except for service during the world was as a captain of engineers.

CHARLES BROWN, city sewer engineer, Indianapolis, Ind., has resigned after thirty years of service in the engineering department of the city.

WALTER S. TODD, formerly assistant bridge engineer for the Illinois division of highways, is secretary-treasurer of a new firm, the Sterling Bridge Construction Co., Sterling, Ill., organized for the construction of highway bridges. F. H. Heivilin, former superintendent of construction for the Koss Construction Co., is president of the company.

DAVID C. BOSWELL has been appointed town engineer of Ridgefield Park, N. J., after having been for the past seven years a resident engineer of the New Jersey State Highway Commission.

FRANK C. LINGENFELTER has been appointed city engineer of Indianapolis, Ind., succeeding John L. Elliott; Mr. Lingenfelter has been civil engineer at Indianapolis since 1918. Charles Brown, city sewer engineer, has resigned after thirty years' service.

J. W. ORROCK, formerly principal assistant engineer of building construction for the Canadian Pacific Ry., has been appointed engineer of buildings to succeed D. H. Mapes who has resigned to enter business.

F. G. SWITZER, recently promoted to the position of professor of hydraulics at Sibley College, Cornell University, has been granted a leave of absence in order to undertake work for the Alabama Power Co. He will be located in the engineering department of the Birmingham office.

J. M. BRAXTON, U. S. assistant engineer located at Jacksonville, Fla., has resigned from the U. S. Engineer Department after twenty-seven years' connection therewith, and has opened an office in the St. James Building, Jacksonville, for consulting engineering practice on improvements of rivers and harbors, water front property, wharves, piers and terminals.

STANLEY T. BARKER, senior assistant sanitary engineer, Illinois State Department of Health, has resigned to take a position with the Newark Concrete Pipe Co. The position will be filled by A. F. DAPPERT, who has been on the sanitary staff for two years. Other recent appointments of assistant sanitary engineers to the staff are V. B. LAMOUREUX, M. S. SABIN and CHARLES HOPPER.

THOMAS VICKERS, civil engineer, recently of the British Cast Iron Research Association, has commenced in private practice as a consulting engineer in foundry work with offices at 14 New Street, Birmingham, England. Mr. Vickers is the president of the Institute of British Foundrymen, Birmingham Branch.

J. ROSS CORBIN, associate geologist, Pennsylvania Geological Survey, recently conferred in Philadelphia with S. M. Swaab, consulting engineer to the mayor, and the Philadelphia Water Supply Commission, and its engineers, relative to the geological aspects of new water supplies for the city of Philadelphia.

WALTER M. STONE is now with the structural division of Stone & Webster, Inc., Boston, Mass.; he was formerly a member of the engineering firm of Stone, Bigelow & Tirrell, of Boston.

Obituary

WILLIAM LEE SISSON, consulting engineer, Rockville Center, Long Island, died May 19 in a New York hospital from fever contracted while making surveys in South America; he was 62 years of age. Mr. Sisson, after eighteen years with the Baltimore & Ohio R.R. in which he rose to the position of assistant engineer in charge of various projects in track maintenance, rock work, bridge construction, tunnel and trestle work and grading, became associated with the National City Bank of New York City and served in an engineering capacity on projects in Central and South America.

ANDREW J. GAVETT, consulting engineer to the city of Plainfield, N. J., and for some years its street commissioner, died in that city May 25, aged 71 years. Mr. Gavett was at one time engineer of maintenance-of-way for the New York Central & Hudson River R.R., and subsequently was engaged on various macadam and brick paving projects in New York and New Jersey; in 1894 he was construction engineer of the Plainfield brick sewer system.

COLIN R. WISE, city engineer of Passaic, N. J., died May 19 at his home in that city, in his 79th year, after a short illness. Mr. Wise was born in Washington, Pa., but his family lived for a time in Georgia and he served in the Confederate army. Later, after graduation from Dartmouth College in 1868 he did field engineering work for various railways and in 1873 became chief engineer of the New Jersey & New York R.R. in Rockland County, New York, and subsequently served on construction for the Erie, West Shore and other railroads, and the Third Avenue Elevated Ry. in New York. In 1889 he became city surveyor of Passaic, N. J., and his title was later changed to city engineer. As city surveyor, he designed the sewer system of Passaic, and in his long service as city engineer he has directed many municipal improvements. Mr. Wise was the founder of the firm of Wise & Watson, Passaic.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Water-Works Equipment Shown at Convention

Seventy Companies Exhibit Products to Members of American Water Works Association

SEVENTY exhibitors of water-works equipment displayed their products in the Grand Ballroom of the Hotel Astor, New York City, last week in conjunction with the forty-fourth annual convention of the American Water Works Association. About 250 representatives of companies holding membership in the Water Works Manufacturers Association and other producing organizations were registered at the meeting. The arrangements for the exhibit were in charge of a committee headed by John E. O'Leary, of the Pittsburgh-Des Moines Steel Co., New York; J. D. Capron, of the U. S. Cast Iron Pipe Co., Philadelphia, and Charles M. Reed, of the Central Foundry Co.

A classification of the manufacturers according to the products displayed showed twelve firms featuring water meters and an equal number engaged in the production of valves and fittings. In third place, numerically, was the field of pipe with eleven producers. Water-works chemicals and equipment for the chlorination or filtration of water had five and four representatives, respectively. There were three manufacturers of meter boxes and allied equipment; three handling pumping and well apparatus; two maintenance and repair equipment for distribution systems. Two companies featured indicating and recording devices for use principally at filtration plants and pumping stations, while an equal number concentrated on steel tanks for water-works use. There were seven manufacturers of miscellaneous products, including valve control machinery, engineering instruments, joint material, water-waste detection devices, water main cleaning apparatus, calculating machines, and testing equipment. The list of exhibitors included, also, six engineering journals.

Water Meters—The water meter exhibit covered a wide range from the small individual service device to the large compound meter and the meter designed to record the use of water for fire purposes. The meter manufacturers included Neptune, Hersey, Buffalo, National, Badger, Van Gilder (a newcomer in the field this year), Worthington, Pittsburgh, Union, Thomson, Gamon and Federal.

Valves and Fittings—The showing of valves and fittings comprised ten makes of pipe valves and two makes of pump valves. The manufacturers in this field included Hays, Eddy, Ludlow, Chapman, Kennedy, Glauber, Ross, Rensselaer, Mueller, S. E. T., Birch, and Sims.

Pipe—In the pipe exhibit a number of varieties were observed, including cast iron, steel, concrete, and service pipe with both lead and cement lining. Several of the makers featured special types of joint, including the Matheson of the National Tube Co., which had samples of its hammer-welded steel pipe on display, the lock-bar joint of the East Jersey Pipe Co., and the universal joint of the Central Foundry Co. There were also the precalked joint of the McWane Co., the concrete pipe joint of the Lock Joint Pipe Co., and a new joint for the cement-lined pipe of the Lap Joint Co. The other exhibitors in this field included the Lead Lined Pipe Co., American Cast Iron Pipe Co., Warren, R. D. Wood, and U. S. Cast Iron Pipe Co.

Chemicals—Alum, chlorine and other chemicals used in the treatment of water were the principal products displayed by Du Pont, Pennsylvania Salt Co., Mathieson, and Hooker Electrochemical Co. In the water sterilization field the representatives were Wallace & Tiernan with their line of chlorinators for both large and small supplies and a new company, the Paradon Engineering Co., of Long Island City, N. Y., which showed for the first time its type of water chlorinating apparatus. A filter operating table was the feature of the booth of the Roberts Filter Manufacturing Co. Exhibit space for filter products was occupied by the F. B. Leopold Co.

Meter Boxes, Pumps and Screens—Meter boxes and accessories were shown by Ford, Bingham & Taylor, and Clark. In the pumping and well field were the Sullivan Machinery Co., with illustrations of its air-lift equipment, portable compressors, and pneumatic tools, E. E. Johnson, Inc., with brass screens for water supplies, and the Kelly Well Co. with a slotted concrete strainer for deep wells. Pipe tapping and valve inserting apparatus and repair sleeves were shown by the A. P. Smith Manufacturing Co. and by the Waterworks Equipment Co.

Indicators—A wide variety of indicating and recording apparatus for water filtration plants, pumping stations, etc., was shown by the Builders Iron Foundry and by the Simplex Valve & Meter Co.

Tanks—The companies specializing in steel tank manufacture were the Chicago Bridge & Iron Works and the Pittsburgh-Des Moines Steel Co.

Equipment not included in the foregoing classifications included the electric valve control mechanism by Payne Dean, Ltd., the engineering instruments by Gurley with a new enamel finish, pipe-jointing material by Leadite, water-waste surveys by the Pitometer Co., cleaning equipment by the National Water Main Cleaning Co., calculating machines by the Elliott-Fisher Co., and testing equipment by the Pittsburgh Testing Laboratories.

Manufacturers Elect Officers

At the annual meeting of the Water Works Manufacturers' Association held May 21, M. F. Tiernan of Wallace & Tiernan Co., was elected president; D. F. O'Brien, of the A. P. Smith Manufacturing Co., vice-president; and Chas. R. Wood of R. D. Wood & Co., treasurer. The only change in the executive committee was the substitution of the U. S. Cast Iron Pipe Co. for the Pittsburgh Meter Co.

To Canvass Makers of Metal Building Materials

Committees Named to Survey Industry as Preliminary to Affiliation with A.G.C.

Washington Correspondence

Committees to canvass all branches of the industry on the proposal to form an affiliated bureau of the Associated General Contractors were appointed by approximately 50 manufacturers of metal building products—sash, fire-doors, skylights, etc.—at a meeting with the Executive Board of the A.G.C. held at Cleveland May 2.

The manufacturers present were unanimously in favor of the proposal to organize into a branch division for co-operative effort with the general contractors' association, as had been done by the concrete mixer manufacturers conferring at Chicago on the day previous. Positive action was delayed, however, until a larger percentage of the industry could be surveyed regarding the matter.

H. F. Wardwell, vice-president of the Detroit Steel Products Co., who presided as chairman of the conference, named the following as group chairmen, each to conduct the survey of all producers of the general lines indicated:

Metal Trim—J. M. Taft, of the J. C. McFarland Co., LaPorte, Ind.

Reinforcing Steel—Gustave Kahn, of the Truscon Steel Co., Youngstown, O.

Metal Partitions—Robert Carpenter, of the Sannmetal Products Co., Cleveland, O.

Steel Sash—Guy D. Bailey, of the Wm. Bailey Co., Springfield, O.

Skylights and *Ventilators*—J. S. Erwin, of the H. H. Robertson Co., Pittsburgh.

Fire Doors—J. C. Wilmot, of the Variety Manufacturing Co., Chicago.

Hollow Metal Windows—Wm. B. Grischy, of the Moeschl-Edwards Corrugating Co., Cincinnati.

Contractors and Makers of Concrete Rollers Come to Terms

An agreement as to the conditions of use and rental charges for the patented rollers used in the surface finish of concrete roads has been reached by the Associated General Contractors and the Macon Concrete Roller Co., owner of U. S. patent No. 1,273,022. Upon application by any contractor who is now or may become a member of the

Associated General Contractors the Macon company will grant a license and right to use its roller and process for finishing concrete pavement at a license fee of $50 yearly for the first year, this sum to include the lease and delivery by the company of one roller. For subsequent years the annual charge is $30.

If the contractor desires additional rollers in excess of one, they will be furnished for a fee of $25 each. In all cases the rollers remain the property of the Macon company. To licensees the right to make rollers for their own use may be granted at a charge of $10 per roller per year. No suits or claims for damages for prior infringement will be made against any member of the contractors' association who subscribes to the agreement outlined above. In the case of contractors not members of the association, the Macon company reserves the right to charge as it sees fit.

Business Notes

SILENT HOIST CO., Brooklyn, N. Y., has appointed the Direct Sales Co., Toronto, as its representative for Canada. The personnel of the distributing company includes M. R. Griffiths, J. S. Stauffer and J. F. Fryer. They will handle the Silent Hoist line of motor truck winches, electric and gasoline hoists and car pullers.

LAKEWOOD ENGINEERING CO., Cleveland, has received and is building for the State of Michigan one of the largest single orders for road equipment placed in some time. It consists of 13½ miles of riveted track, with pressed steel ties; 900 batch boxes, 37-cu.ft. capacity; 450 cars 7 finishers; 7 floatbridges; 12 adjustable steel subgraders; 60 tunnel traps; and other miscellaneous items. This equipment is for use in conjunction with the 1924 paving program, which will be carried on by the State forces.

CAMBRIA CLAY CO., Patton, Pa., has opened offices in the Renshaw Building, Pittsburgh, and at 1600 Walnut St., Philadelphia, to handle the company's line of face and common brick, and fireproofing material.

NORTHWEST ENGINEERING CO., Chicago, manufacturer of power shovels, draglines and cranes, announces the opening of a new office at 101 Marietta Ave., Atlanta, Ga., in charge of M. B. Ogden, who has been connected with the contracting and engineering field for some time.

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, announces that its New York and Eastern office is now in charge of A. H. Ellison, at 50 Church St., New York City. Mr. Ellison was formerly connected with the Clyde Iron Works of Duluth, serving as Eastern manager for that organization for the last eight years.

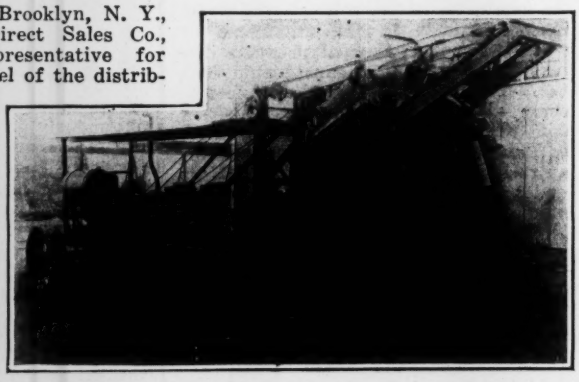
Equipment and Materials

Water-Works Equipment

For this, the annual Report Issue of "Engineering News-Record," following the convention of the American Water-Works Association in New York, May 19-24, the following descriptions relate to equipment of interest chiefly to the water-works field.

Trench Digging Wheel Has Improvised Spoil Conveyor

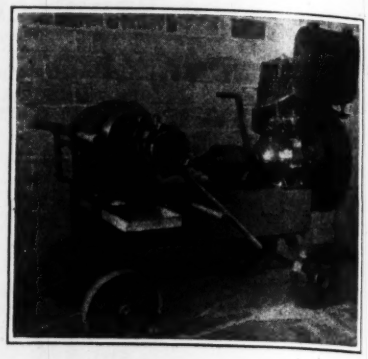
A new and improved digging wheel has been designed and placed in operation on the Pawling & Harnischfeger's Model 122 wheel type trencher as illustrated in the accompanying illustration. One of the main features of the new digging wheel is the spoil conveyor which is frequently a cause of trouble on trenching machinery due to dirt getting into the working parts and damaging the machinery. To avoid this, the spoil conveyor on the new wheel is totally enclosed in an oil-tight gear case, cut gearing being used for the driving mechanism. A slip friction is provided to guard the gear train against breakage should the conveyor become stuck. The conveying belt itself is of the overlapping metal slot type designed for long service.



Another feature of the new digging wheel is the increased effective bucket width made possible because the driving teeth are cast on the inside of the wheel rim instead of at the side of the rim as was the practice formerly. The wider busket makes possible easier clearing of sticky mud from the bucket. If the digging is in especially sticky mud then a special patented self-clearing bucket with hinged back can be provided. The wheel frame of the new machine is more rigidly braced than formerly. Heavy structural members are used for this purpose and give the wheel rigidity.

Power Drive for Pipe Threading or Cutting

For threading or cutting off pipe, bolts or rods, Brainerd & Toulson, Endicott, N. Y., have developed a portable power drive operated either by electric motor or gasoline engine. The machine is equipped with two three-jaw geared chucks which operate at 12½ r.p.m., into which the pipe or rod is clamped and turned. Right-hand threads are cut at one side of the machine and left-hand threads on the other. All sizes of pipe up to 2 in. are threaded directly in the machine without the use of a bench or vise. The machine uses any make of hand dies, there being two stop rods which hold the dies and cutting off tool from turning while the thread is being cut.

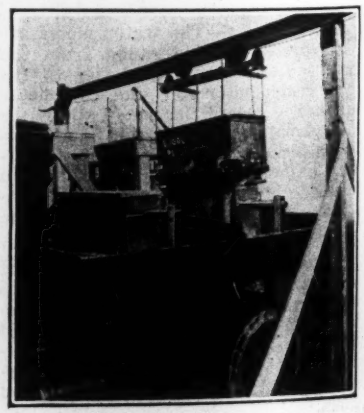


For operating geared dies for pipe from 2½ to 12 in. there is supplied a universal telescopic shaft, one end of which is fitted to grip in the chuck jaws and the opposite end is attached to the end of the pinion shaft on the gear die at the point where a ratchet handle is used when cutting by hand.

Cement-Handling System for Road and General Construction

To eliminate labor in handling cement at the paving mixer and to equalize loading operations at the cement shed, the Blaw-Knox Co., Pittsburgh, has developed a cement-handling system consisting of two parts. The first is a quick-acting cement charger or hopper with a four-leaf drop-bottom door which runs on an I-beam trolley extending from the cement shed over a motor truck runway. The operator releases the cement charger which moves by gravity to position over the truck compartment.

The second part of the system is installed in the bodies of motor trucks. Where specifications demand that the cement be kept dry and intact, away from the sand and stone, a special container must be provided. Therefore in each truck compartment an all-steel



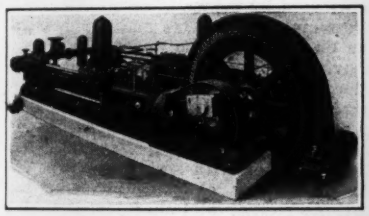
container is placed and hinged by adjustable standards on the sides of the truck body. Two, three or more of these cement containers are used, depending on the number of compartments in the truck.

In operation, when the truck body is elevated and the material compartment released, the cement container, being hinged, remains in a vertical position. A drop-bottom door opens automatically releasing the cement with the sand and stone. The opening at the bottom of the cement container, being larger than at the top, will clean itself. Where state specifications permit the dumping of cement with the coarse aggregate the cement containers are not needed, but the chargers will be found useful.

Aside from the rapidity with which the cement is loaded into the cement pockets the charger permits a uniform employment of time on the part of the laborers at the cement shed.

Pump Cylinders and Valve Chests Bored in Same Steel Billet

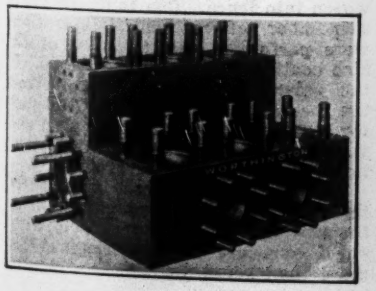
Water-works pump cylinders bored in solid steel forgings, with the suction and discharge valve chests contained integral in the same billet as the cylinder, are features of two pumps, each to deliver 1,800,000 gal. per 24 hr. against 1,360 ft. head, built last year by the Worthington Pump & Machinery Corporation, New York. These pumps supply water to an Arizona town. The nearest available water is 7 miles



across the desert, and at a depth of approximately 700 ft.

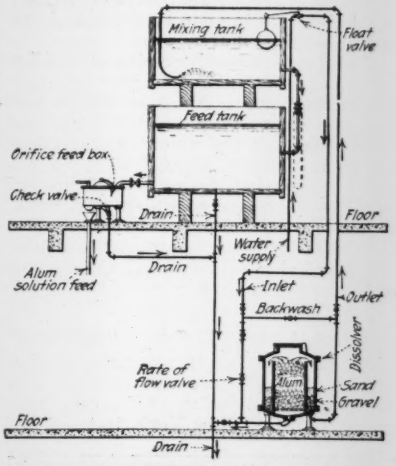
The pumps are located in an underground chamber with other Worthington units installed in 1916 and 1918. Low-head deep-well pumps deliver the water to a reservoir cut out of the rock near the pump chamber. The two new units draw their supply from this reservoir, pump it approximately 700 ft. to the surface through a vertical pipe, and thence 7 miles across the desert.

A 525-hp. synchronous motor is mounted directly upon the crankshaft of each pump. The crankshaft operates at a speed of 72 r.p.m. The pumps are duplex double-acting, with 7½-in. center-packed plungers of chilled iron running 24 in. stroke.



Chemical Transport Dissolver

There has been developed by the Roberts Filter Manufacturing Co., Darby, Pa., dissolving and transporting apparatus for preparing chemical solutions of predetermined strength, filtering these solutions and transporting them under pressure to elevated tanks. The installation consists of a dissolver in which a weighed quantity of alum is placed, a mixing tank placed over and connected to a feed tank and a chemical



regulator box with connecting piping; a typical arrangement is shown in the accompanying drawing.

The dissolver is of cast iron and has an inner compartment with a perforated bottom through which water under pressure is admitted to dissolve the chemical. A filter of sand and gravel layers forms the outer compartment, which is equipped with a perforated pipe lateral under the gravel for collecting the solution and distributing the water used in washing the filter. The cover is hinged and provided with swing bolts with wing nuts for quick opening and closing.

A mixing tank of wood or concrete measures the quantity of water required to make up the necessary strength of solution, a float valve automatically cutting off the flow through the dissolver when the quantity of water required to make up the predetermined strength of solution is reached. The feed tank, directly under the mixing tank, has a capacity from one-quarter to one-third greater than that of the mixing tank to allow for overlapping of runs.

The dissolvers are manufactured in sizes ranging from one cu.ft. or 50 lb. to 50 cu.ft. or 2,500 lb. per charge; the number of charges per day can be proportioned, depending on the size of the plant, up to six charges per 24 hr.

Among the advantages claimed by the manufacturer for the chemical transport dissolver are the following: Dissolver placed at any location remote or adjacent to the mixing or feed tanks; labor minimized; freedom from dust and dirt in the plant caused by the handling of the chemicals; uniformity of weight of charge and no time lost or errors made in calculating the quantity of chemical required per charge; accurate predetermined strength of solution is obtained.

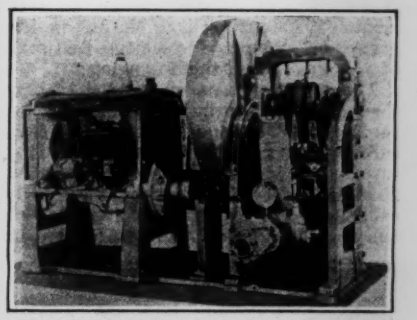
Thin Cement Lining Applied to Cast-Iron Pipe

The application to cast-iron pipe of an interior cement lining only $\frac{1}{16}$ in. thick, as compared with thicknesses of from $\frac{1}{8}$ to $\frac{1}{4}$ in. formerly attained, has been made possible by an improved process developed by the American Cast Iron Pipe Co., Birmingham, Ala. For the thin lining great density and intimate contact with the pipe surface are claimed. The process was developed to meet special conditions in Charleston, S. C., where quality of the water caused severe tuberculation of the city water mains. The new thin lining is applied by a centrifugal method and at present an ordinary portland cement mixture is used. The company's research department, however, is experimenting with the use of other types of cement to determine finally the most satisfactory lining.

In addition to the fact that it does not materially decrease the nominal inside diameter of the pipe, the thin lining of cement is claimed to improve the hydraulic properties of the pipe. Experience with the product, its manufacturers point out, indicates that the value of the flow coefficient, *C*, as applied in the Chevy formula, is raised from 25 to 30 per cent above that for new cast-iron pipe, and is about 25 per cent higher than for tar-coated pipe.

Filter Back-Wash Pump Driven by Gas Engine

For back-washing sand in the filter beds of the smaller municipal, industrial or institutional water-works the Buda Co., Harvey, Ill., has placed on the market a new 20-hp. gasoline power unit designed for direct connection to a centrifugal pump. The units for this work are built either with or without radiators, depending upon the requirements; when the radiator is not furnished a new type of control board is located at the front of the engine.



An extra large radiator is supplied, together with a fan of large diameter, when this method of cooling is specified. The use of the radiator, the manufacturer points out, eliminates any trouble from over-cooling or over-heating which sometimes occurs when the operator does not regulate the water valve correctly.

Another type of pumping plant which is now available is the high speed unit direct-connected to centrifugal pumps for fire or other emergency service. Buda power units are built in sizes from 20 to 55 hp.

New Portable Scraper Unit Has ¾-Yd. Bucket

A new and larger portable scraper unit is announced by Sauerman Bros., Chicago. This outfit consists of a ¾-yd. Crescent scraper bucket, operating cables, all necessary guide blocks, bridle anchorage system and portable hoist.

Power may be furnished by a 35-hp. gasoline hoist, a 25-hp. electric hoist, or a belt hoist designed for operation by a 25-hp. electric motor or tractor.

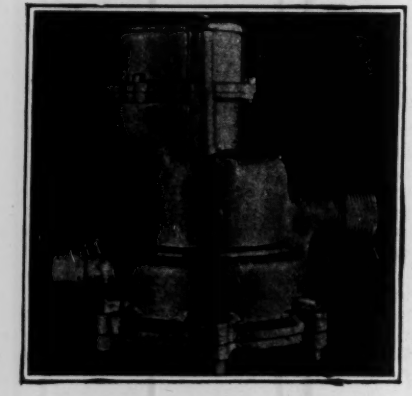
These units were designed in response to the demand for a portable scraper to be used with the larger portable crushing and screening outfits now on the market. When intended for a permanent plant installation the equipment is furnished with the hoist mounted on skids instead of on trucks.

The ¾-yd. unit will supplement the ½- and ¾-yd. portable scraper outfits and the standard Sauerman power drag scraper systems for material-handling at sand and gravel plants, concrete products factories, and on work done by contractors and county road commissions.

New Water Meter on Market

A new water meter has been placed on the market by the Van Gilder Water Meter Co., Pleasantville, N. J., which has recently been organized with Lincoln Van Gilder, chief engineer and superintendent of the water department of Atlantic City, N. J., as its president. Among the special features of the meter are the following:

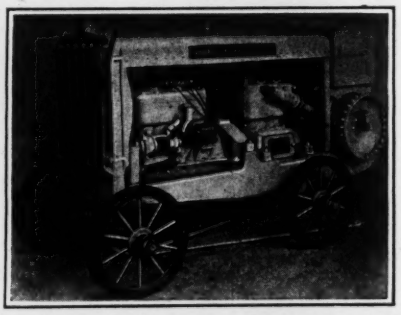
The register chamber is filled with a clear, white oil entirely submerging the register and change gears. This feature is designed to eliminate corrosion, insure long life, make the use of direct reading registers practical under all conditions and prevent any sweating of the register glass. Another feature is the enclosed, oil-filled gear train. Two spur and two worm gears constitute this simplified train and are made of monel metal, as well as the spindles, which are rubber-bushed. This arrangement, it is claimed, gives a much greater reduction than is usual, reduces the wear on the stuffing box and gives greater sensitivity to the driving pawl. Offset spuds are provided to stop the formation of air pockets and consequent breakage of discs, and to prevent the meter being reversed in line. A special coupling can be furnished for use in straight lines.



To overcome the necessity of having to replace some damaged parts in case the meter freezes, Mr. Van Gilder has designed a specially treated cork disc in the base of the meter which takes up the expansion when frozen. Tests made at 18 deg. below zero failed to damage the meters, which registered accurately after being thawed out. The usual design of separating disc chamber, but with monel metal diaphragm and spindle, is used.

A 100-Cu.Ft. Portable Compressor

A new 100-cu.ft. gasoline-engine driven portable air compressor has been developed by the Chicago Pneumatic Tool Co., New York, to meet the requirement for an air unit handling one rock drill. This compressor will also operate two concrete busters or two clay diggers, two riveting or calking hammers, or four backfill tampers.

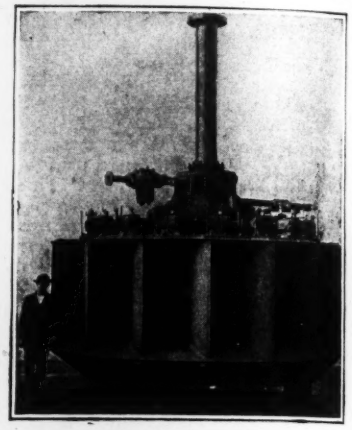


The compressor is of the vertical, single-acting duplex type equipped with Simplate inlet and discharge valves. The differential unloader regulates the air supply and the auto-pneumatic throttle provides additional fuel economy by slowing the engine to idling speed during the unloaded periods and speeding it up again just before the load is resumed. Splash lubrication is used and a small pump, gear-driven from the crank-shaft, maintains a constant level of oil in the connecting-rod splash-troughs and supplies oil to the main bearings.

A flexible coupling, which can be quickly disconnected for starting, when desired, connects the compressor directly to a heavy-duty four-cylinder gasoline engine. Both engine and compressor are cooled by a large capacity radiator, built in sections and protected against damage by seven vertical bars. The complete unit is supplied in the regular steel-wheel or rubber-tired portable model, the rubber-tired trailer type or mounted on a 1-ton Ford truck chassis.

Three Turbines to Supply Power for City's Water Works Pumps

Three large single vertical-shaft turbine water-wheel units, each capable of developing 2,700 b. hp. under a 26-ft. working head, are being completed for the City of Watertown, N. Y., by the S. Morgan Smith Co., York, Pa. Installed in a concrete spiral flume, each turbine will drive a direct-connected generator for operating water-works pumps and other equipment in the city pumping station; surplus power is to be used for street lighting.



All moving parts of each turbine and gate mechanism are bronze bushed and lubricated by means of an Alemite compression system. One main guide bearing on the top of the turbine is the only bearing on each unit, and this is of special design, with lignum vitae renewable strips which are water lubricated by means of water taken from the spiral flume and passed through a twin strainer with sight-feed. The entire revolving element, including the turbine runner and shaft, is suspended from the thrust bearing on the top of the generator to which the turbine is direct-connected. This equipment is being installed under the supervision of P. B. Sutton, city engineer, and J. Walter Ackerman, city manager of Watertown, N. Y.

Galvanizing Applied to Wire Fence After Weaving

To increase the life of woven-wire fence the Page Steel & Wire Co., Bridgeport, Conn., has adopted the process of galvanizing after weaving, by which is applied a protecting coat of zinc several times heavier than that on ordinary galvanized fence. Formerly the wire of which fence was made was first galvanized and then woven into fence. Due to the fact that a number of mechanical operations were performed, the thickness of the zinc coating was definitely limited. In the galvanizing-after-weaving method, the mechanical operations are all performed first, and the fabric is then galvanized, thus permitting the application of a heavier coating of zinc.

In service tests wire bearing the thickness of coating that is applied by the new method has successfully withstood exposure in New England for more than seven years.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Cost of Crushed Stone on Pennsylvania Highway Jobs

The cost per ton of crushed stone in Pennsylvania state highway construction is shown in the following tabulation of lettings during the first quarter of the current year.

Approximately 900 bids were received by the Highway Department for crushed stone f.o.b. quarry and also delivered at 238 different points throughout the state. Out of the 900 bids, a total of thirty-two firms were awarded contracts in twenty-nine counties.

The price at quarry ranged between $1.55 and $1.60; the minimum price at destination was $1.80, with the maximum at $3.15; f.o.b. road, the quotations were $1.65 to $3.35 per ton.

The three largest items were 14,610 tons at $2.45 per ton, f.o.b. destination, awarded to Winston & Co., Harrisburg, Pa., total, $35,794; 17,700 tons at $1.90 per ton, f.o.b. road, awarded to J. C. Showalter, New Holland, Pa., $33,330 and 10,000 tons at $3 per ton, f.o.b. road, to the National Limestone Co., Naginey, Pa., $30,000.

In the accompanying table only the heaviest tonnages are shown at the respective f.o.b. points.

CRUSHED STONE AWARDS—PENNSYLVANIA HIGHWAY DEPT.

Name of Contractor	Tons	Price per Ton, f.o.b. Destination	Price per Ton, f.o.b. Quarry	Price per Ton, f.o.b. Road	Total Cost
Booth and Flinn Co., Pittsburgh, Pa.	1,000	.....	$1.60	.....	$1,600
Gasparis Stone Co., Columbus, O.	1,300	.....	1.55	.....	2,015
Geo. M. Bushey & Sons, Cavetown, Md.	5,574	$2.00	.....	.....	11,148
	8,361	2.10	.....	.....	17,558
Epley Building and Supply Co., York, Pa.	3,220	.....	.....	$2.60	8,372
	6,600	.....	.....	2.35	15,510
General Crushed Stone Co., Easton, Pa.	4,250	2.05	.....	.....	8,712
	4,508	2.35	.....	.....	10,593
	4,500	.....	.....	2.55	11,475
Herbert L. Gingell, Fairfield, Pa.	7,720	.....	.....	2.50	19,300
Highway Stone and Service Co., Blue Ball, Pa.	3,400	.....	.....	2.35	7,990
	4,000	.....	.....	2.25	9,000
Clyde B. Johns, Malvern, Pa.	3,300	.....	.....	2.60	8,580
	4,560	.....	.....	1.65	7,524
National Limestone Co., Naginey, Pa.	10,000	.....	.....	3.00	30,000
	8,000	.....	.....	3.25	26,000
J. C. Showalter, New Holland, Pa.	17,700	.....	.....	1.90	33,630
Chas. Warner Co., Philadelphia, Pa.	6,000	.....	.....	2.90	17,400
Winston and Co., Harrisburgh, Pa.	14,610	2.45	.....	.....	35,794

Awards for Public Work Gain in Northwest

Improvement in the Western business situation has been reported during the past week. Better demand for building materials; plentiful supply of labor; increased buying of general merchandise and the mobilization of railroad facilities for handling the grain crop are taken as indications of a betterment in conditions in that section of the country.

Despite recent reports of bank closings and other signs of depression in the Northwest, there has been a slight gain, during the past month, in letting of contracts for public works in the states immediately west of the Mississippi.

April awards for water-works, sewers, excavations, drainage and irrigation projects were greater, in money value, than those of the month preceding; water-works and sewer lettings exceeded those of April, 1923.

Bridge contract letting fell off during April but showed a gain compared with the corresponding period last year. Total lettings for industrial and commercial buildings, streets and roads declined in money value during the past month and were also under those of a year ago.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 311 to 324, are the following:

Hotel, Dallas, Tex., Baker Hotel Co. to Gilsonite Constr. Co., $3,250,000.

Hotel, Springfield, Ill., Abraham Lincoln Hotel Co. to J. C. Evans, $1,500,000.

Waterworks Impvt., St. Louis, Mo. of Frazier-Davis Constr. Co., $1,068,228.

Reservoir, Cincinnati, O., Dir. of Pub. Service to M. Penker & Sons, $579,462.

Warehouse, San Pedro, Calif., Petroleum Export Corp. by day labor, $2,500,000.

Street and office buildings, Buenos Ayres, Argentina, to George Nolan Inc. of New York, $35,000,000.

Demand for Steel, Lumber and Cement Slower Than Year Ago

That demand for at least three of the basic building materials has subsided during the past month, is evident from the accompanying statistics.

A falling off in steel production and demand, this year compared with last, is shown in the following tabulation:

	Steel Ingots—Tons		Unfilled Orders—Tons	
	1924	1923	1924	1923
Jan.	3,446,143	3,644,629	4,798,429	6,910,776
Feb.	3,612,631	3,294,264	4,912,901	7,283,989
Mar.	3,971,844	3,858,675	4,782,807	7,403,332
Apr.	3,211,525	3,760,997	4,208,447	7,288,509
4 Mo's.	14,242,143	14,558,565		

The steel ingot figures are from the American Iron and Steel Institute and represent the reports of companies which in 1923 produced 94.84 per cent of the total production of steel ingots in that year.

The unfilled tonnage figures represent orders on books of the United States Steel Corporation on the last day of each month.

An increase in softwood lumber production with diminished shipments and demand, is shown by the following comparison of the lumber movement for the first eighteen weeks of this year with that of the corresponding period in 1923:

	1924 Ft.b.m.	1923 Ft.b.m.
Production	4,100,343,753	3,943,289,149
Shipments	4,153,671,490	4,404,538,481
Orders	3,951,422,213	4,367,698,458

The lumber figures are from 369 mills reporting regularly to the National Lumber Manufacturers' Association. For the year so far, production is between 4 and 5 per cent larger than for like period of 1923, while shipments have fallen off about 5 per cent, and cumulative orders about 9 per cent.

The cement situation, comparing the first four months of the current year with the corresponding period in 1923, is one of increased production, decreased shipments and greatly increased reserve stocks at mills throughout the country, as follows:

	Production (Barrels)		Shipments (Barrels)		Mill Stocks at End of Month (Barrels)	
	1923	1924	1923	1924	1923	1924
Jan.	7,990,000	8,788,000	5,628,000	5,210,000	11,477,000	14,155,000
Feb.	8,210,000	8,588,000	6,090,000	5,933,000	13,596,000	16,815,000
Mar.	9,880,000	10,370,000	10,326,000	8,995,000	13,045,000	18,189,000
Apr.	11,359,000	11,726,000	12,954,000	12,771,000	11,463,000	17,144,000
4 Mo's.	37,439,000	39,472,000	34,998,000	32,909,000	.....	.....

Cement statistics are from the Geological Survey and are based mainly on reports of producers but in part on estimates.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 311 to 324, are the following:

Subway, Cincinnati, O. by Rapid Transit Comrs., $1,000,000.

High School, Kenosha, Wis., by Bd. of Education, $1,000,000.

Hotel, Dallas, Tex., for Hilton Hotel Company, $1,000,000.

Hearing on European Cement Dumping Case Set for June 6

A hearing will be held June 6 before McKenzie Moss, Assistant Secretary of the Treasury, on charges that European exporters are dumping portland cement in the United States market. All importers and domestic producers concerned in this subject are invited to attend or to file briefs on or before June 6 and collectors of customs who have withheld liquidation of portland cement importations on suspicion of dumping have been instructed to forward papers in these cases to Judge Moss.

Opportunity also will be given for presentation of briefs subsequent to the hearing and interested parties will be permitted to examine each other's briefs.

Charges that portland cement is being imported at prices less than the fair market value, which is a violation of the anti-dumping law, have been made frequently in the last year. The hearing will bring to a climax an investigation which has been conducted by agents of the Treasury Department.

"A Half Century of Prices and Wages in the Construction Industry 1874-1924"—If you want this 4-page leaflet, write The Editor, Engineering News-Record, 10th Ave. at 36th St., New York.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of May 1, the next, on June 5.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.59	$3.80	$4.40	$3.30	$3.55	$4.20	$3.60	$3.60	$4.20
Structural rivets, 100 lb.	4.00	4.35	4.90	3.75	4.00	5.15	5.00	4.25	5.00
Reinforcing bars, ¾ in. up, 100 lb.	3.49	3.30	3.38	3.20	3.45	3.85	3.65	3.50	3.90
Steel pipe, black, 2½ to 6 in. lap, discount	44%	54.2%	43%	47%	55.05%	36%	36.80@49.10%	45%	47.43
Cast-iron pipe, 6 in. and over, ton	61.60@63.60	—54.00	61.00	57.20@60.20	60.50	68.00	59.00	65.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	2.25
Gravel, ¾ in., cu.yd.	1.75	2.00	2.38	2.00	1.85	1.90	2.15	1.50	1.50
Sand, cu.yd.	1.25	1.40	2.00	2.00	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	60.00	40.00	60.22	53.50	—38.75	49@53	36.00	25.00	65.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.60	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.65	1.85	1.50	1.40	2.70	2.10	2.80	10.50
Common brick, delivered, 1,000	23.65	12.00	14.10	11.00	—14.00	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.091	.11	.064	.075	.075	.....	.11	.12
Hollow partition tile 4x12x12, per block	.1162	.091	.11	.....	.....	.075	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.98	—.98	+1.14	.94	1.08	1.16	1.05	1.13	1.23
Common Labor:									
Common labor, union, hour	.75	.30	.....	.....	.....	.....	.55	.62½	.....
Common labor, non-union, hour	....	.25	.30@.50	.82½	.50@.55	+.50@.55	50	.62½	.25

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93½c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on Douglas fir instead of pine. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 98.46). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in. $119.

Conditions Affecting the Market

Curtailment of output continues in most of the basic industries. The four most important to show contraction of production schedules are: Steel, lumber, coal and textiles.

A cautious buying policy is still in force, few purchasers seeming inclined to make commitments beyond immediate needs. The trend of demand in the direction of small-tonnage lots, however, has prevented over-expansion of building materials reserve stocks.

In accordance with the usual seasonal trend of lumber demand, there was an increase in new orders during the week of May 17 of about 12,000,000 ft., or 6 per cent more than the week before, according to the National Lumber Manufacturers' Association. New business is heavier than during the corresponding period in 1923.

The iron and steel market has also improved in tone. Pig-iron inquiries are more frequent. Sales of No. 2 fdry. iron, however, are nearer $22 than $23 per ton f.o.b. Birmingham. Scrap prices are advancing. Better demand for steel sheets, bars and tin plate is also reported. Mill prices of steel pipe are firm at present levels. Quotations on steel shapes range between $2.10 and $2.25 per 100 lb., at mill; plates are $2 and $2.25 and bars, $2.20 and $2.25.

The three most important building-trades strikes now active are: The demand of 1,600 structural iron workers in New York City for a 44-hr. week and a wage increase of $1.50 per day, making $12; painters' strike in Kansas City for a wage increase of 25 per cent; strike of 3,000 carpenters in Pittsburgh over a wage contract.

The iron workers' strike in New York is tying up operations in other trades. Bricklayers have entered protest at attempts of employers to discharge men who had been receiving a rate as high as $16 per day and hiring new mechanics, available because of the ironworks' strike, at the base wage of $12 per day plus a smaller bonus.